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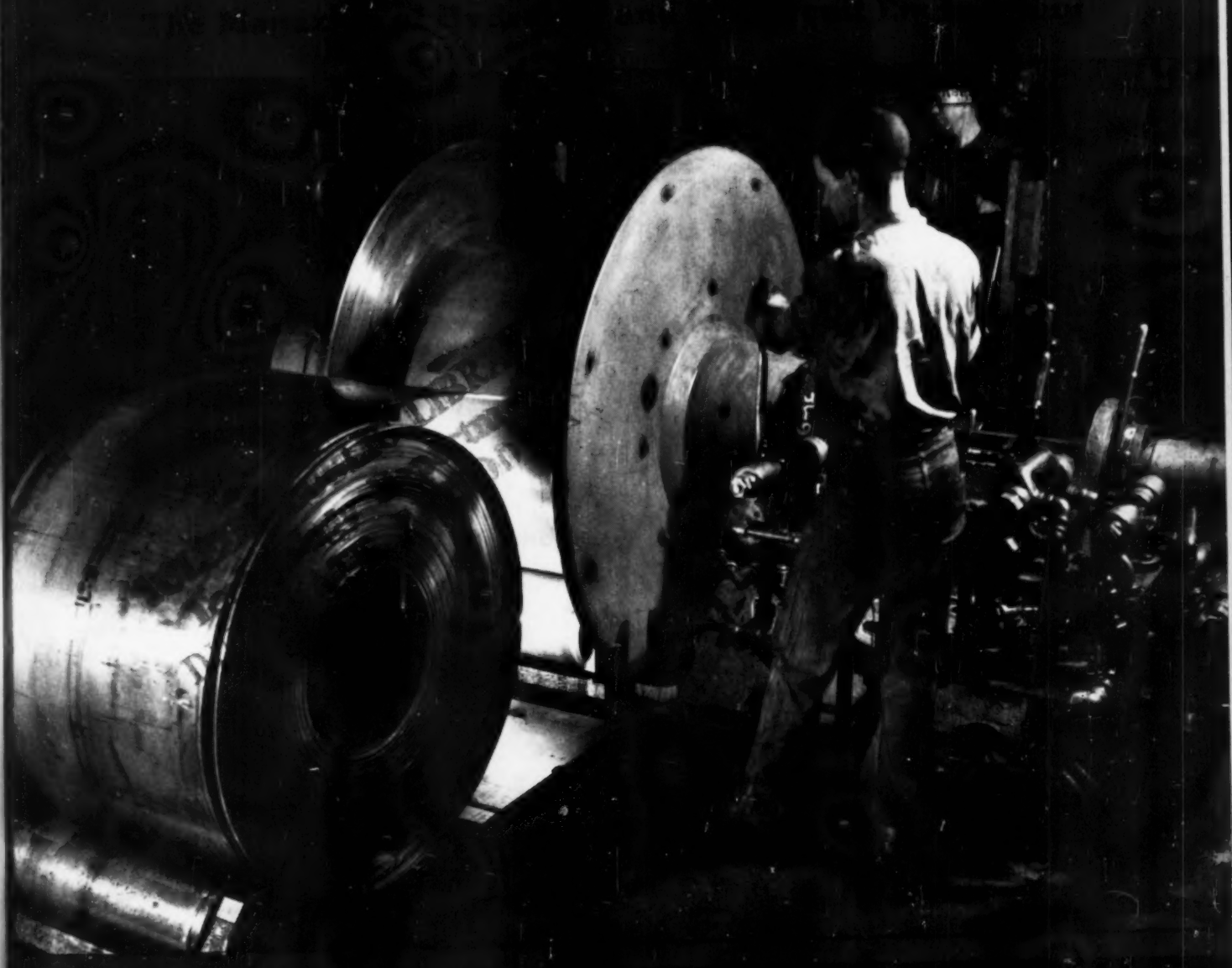
Applied HYDRAULICS



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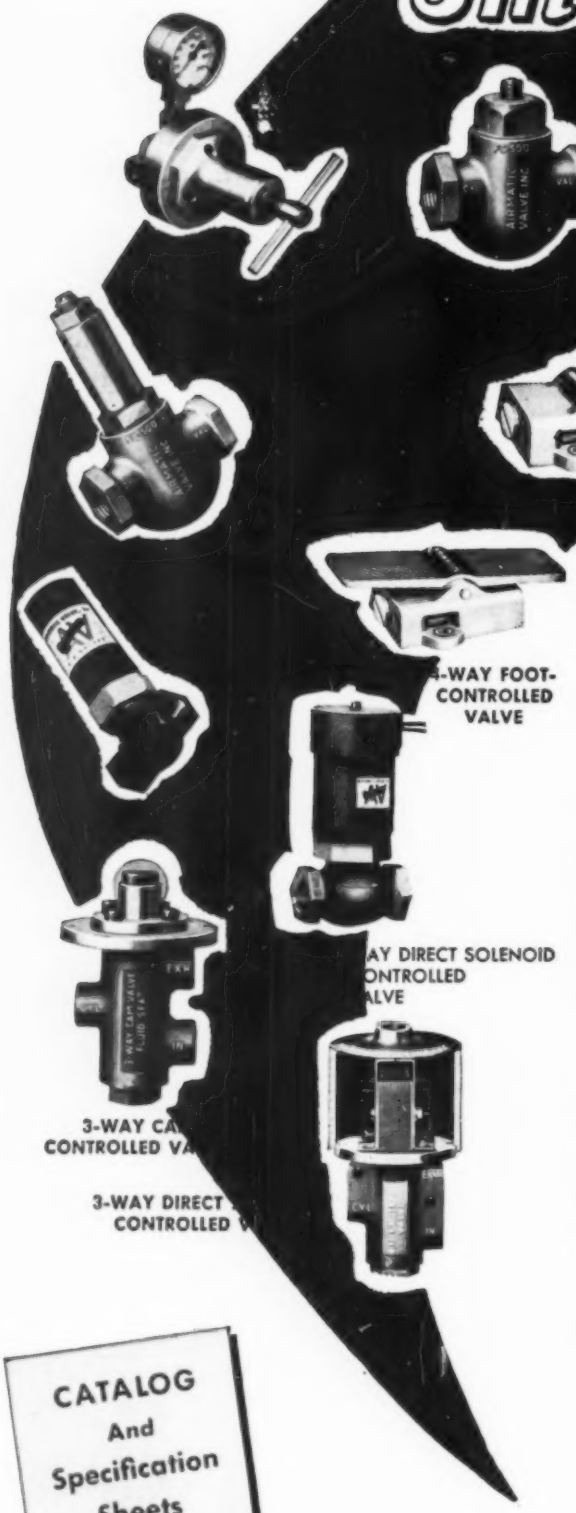

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FRONT COVER: A coil of strip steel being hydraulically fed from the coil box into the new five stand tandem mill at the Aliquippa Works, Jones & Laughlin Steel Corporation, while another roll is being held in readiness on the spinner rolls in the foreground.
—Newman-Schmidt Photo

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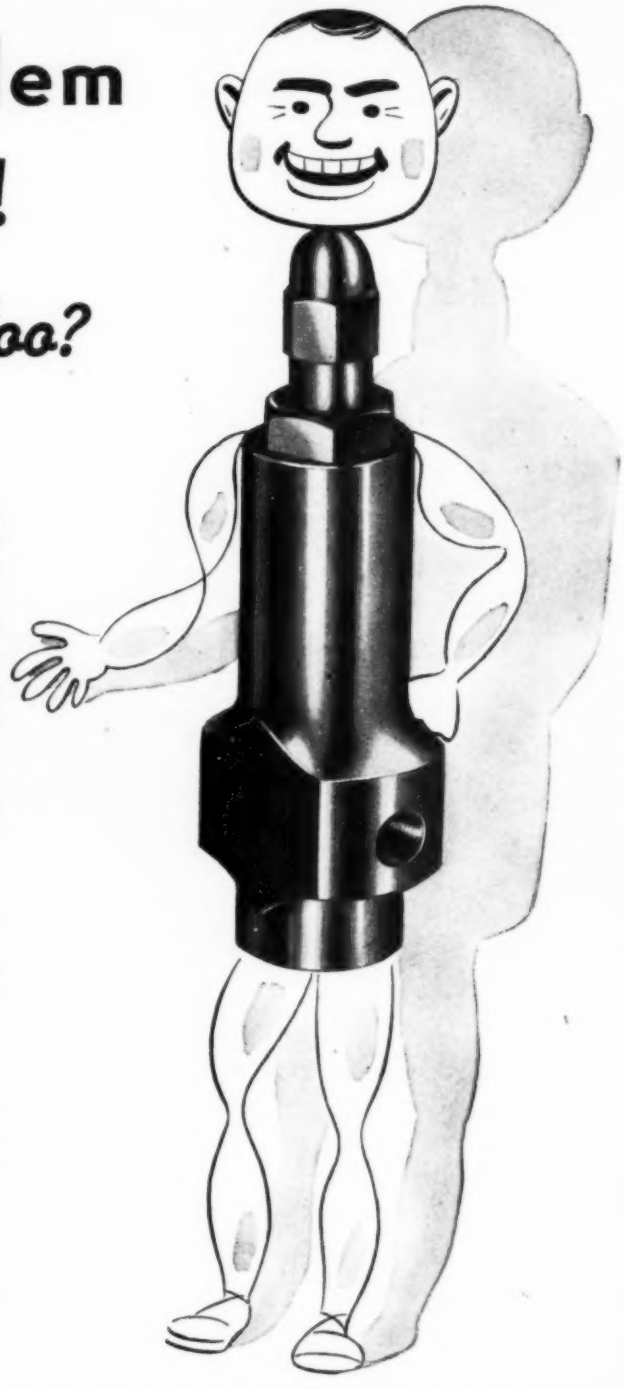

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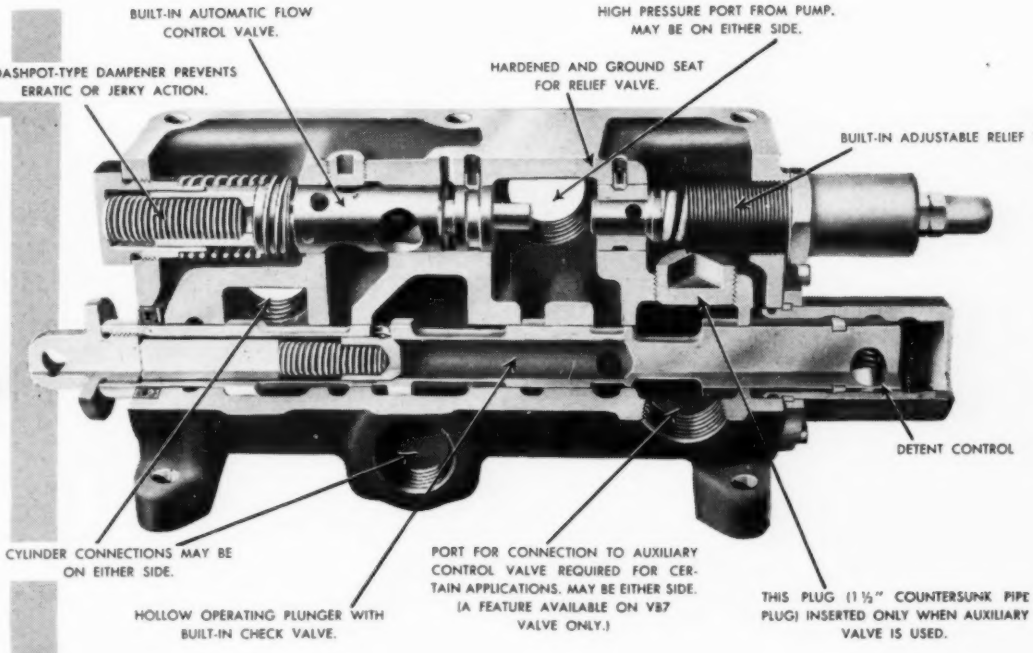
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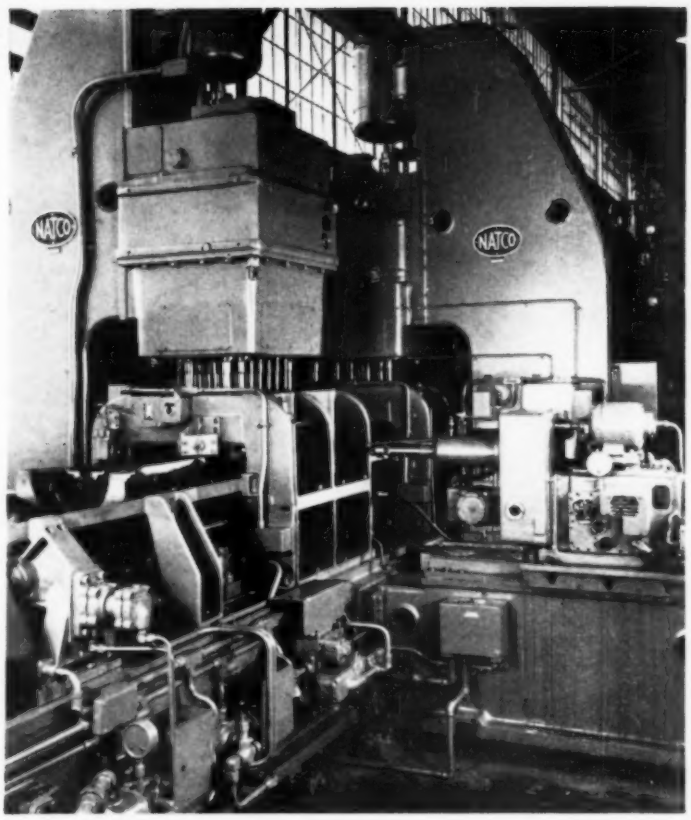


Fig. 1. The last working station of the cylinder block line. The "good housekeeping" layout of motors, valves, reservoirs, piping and other elements simplifies the job of maintenance.

By R. A. SCHAFER and R. MUHL

National Automatic Tool Co.
Richmond, Ind.

STRAIGHT LINE INDEXING

The functioning of a multiple operation machine in which a hydraulically operated and electrically controlled straight line fixture automatically indexes, locates and clamps a cylinder block progressively through 15 stations. This machine is in the cylinder block line of a major manufacturer of automobiles.

A STRAIGHT LINE indexing machine in use at the plant of a major automobile company is a key link in their cylinder block line. The cylinder block is indexed progressively through seven work stations. The fifteen position indexing fixture, which holds one cylinder block in each position, is hydraulically operated and electrically controlled through an automatic cycle of indexing, locating and clamping the part progressively through the stations.

A total of 14 multi-spindle heads are employed, nine of which are hydraulic feed and five mechanical. The hydraulic feed heads perform such operations as drilling, reaming, spotfacing and chamfering. A total of 50 such operations are performed. All of the tapping operations, except one, are done on the last two stations. A total of 39 tapping operations are performed.

Indexing, Locating and Clamping Circuit

The indexing, locating and clamping circuit is a sequencing operation in which all sequence movements are interlocked by electrical limit switch indication. No movement can be initiated until the processing operation has been completed.

Hydraulic power is supplied the system by a double pump and combination valve unit. A manifold pipe system running the length of the machine sup-

plies fluid to controls located adjacent the several operating positions.

To initiate a cycle, a four-way valve solenoid is energized; as the valve is positioned a cylinder rotates the locator bar and shuttle bar to a position with the shuttle bar lug engaged with the block and the locator bar lug disengaged. When this movement is complete, a limit switch energizes the shuttle bar four-way valve solenoid, which causes the transfer shuttle bar to move the block to the next position. When this movement is completed, a limit switch energizes 7 four-way valve solenoids (one for each work position) and applies power to each of the working station elevator hydraulic motors. A pressure reducing valve in the forward or clamp side of each motor allows the torque valve of each motor to be adjusted to the force required for each station. This is important when distortion may cause inaccuracy in finishing operations while high clamp force is required in the machining operations.

In the first working station, an accurate limit switch indicates when the block is seated in location on the rest buttons within .005. When all clamps are effective and the block check switch is closed, the machine head cycles are initiated.

In transferring from station to station, the blocks are located properly, either by the engagement of the shuttle dogs or the transfer bar while in motion, or the stop dogs on the locator bar while at rest.

Elevation of the blocks to the working position over the pan rail dowel pin holes and clamping are accomplished through the use of a geared head fluid motor, a right and left hand

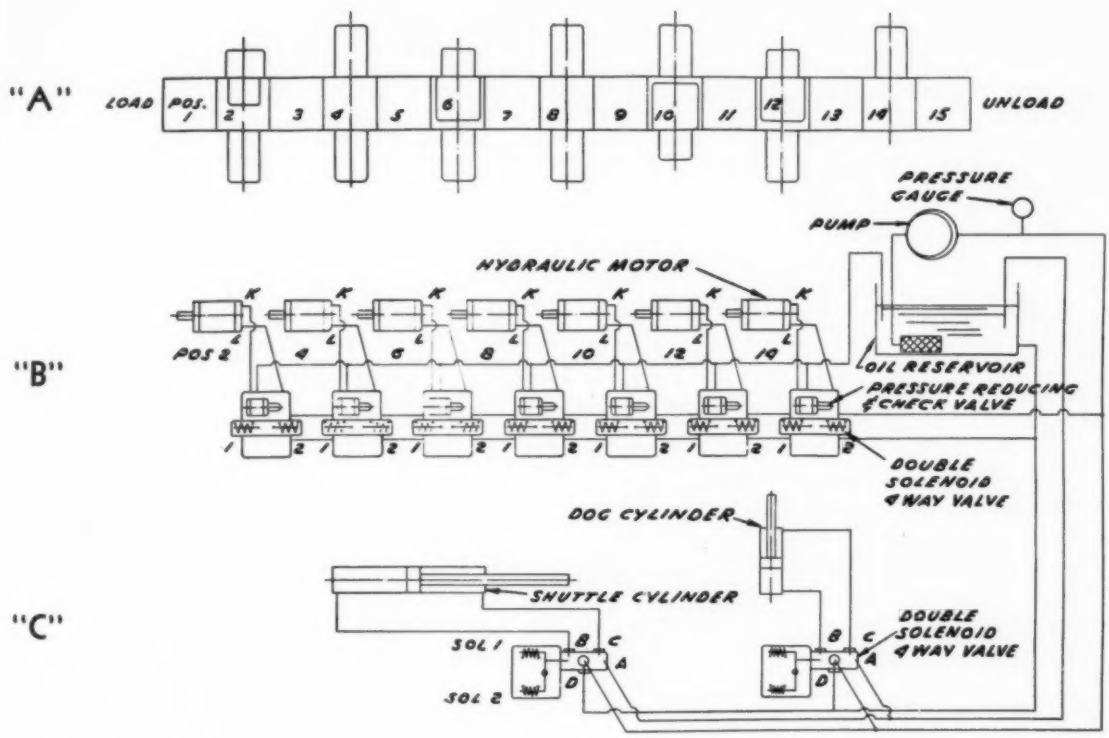


Fig. 2. Hydraulic diagram for traversing and clamping cylinder blocks.

"A" is a floor plan of the machine; "B" shows the arrangement of fluid motors, double solenoid operated four-way valve, pressure reducing and check valves; "C", the arrangement of double solenoid valves for shuttle and dog cylinders. In "B" it is noted that there is a fluid motor, double solenoid 4-way valve and pressure reducing and check valve for each work station. To clamp, solenoid 2 is energized, opening K to pressure and L to tank; to unclamp, solenoid 1 is energized, opening L to pressure and K to tank. In "C" (left), solenoid 1 is energized, opening B to pressure and C to tank. This causes the shuttle cylinder to advance and the transfer shuttle bar to move the block to the next position. To reverse, solenoid 2 is energized, opening C to pressure and B to tank. In "C" (right), solenoid 1 is energized, opening B to pressure and C to tank. This causes the dog cylinder to rotate the locator bar and shuttle bar, disengaging the locator bar lug and engaging the shuttle bar lug with the block. To reverse, solenoid 2 is energized, opening C to pressure and B to tank.

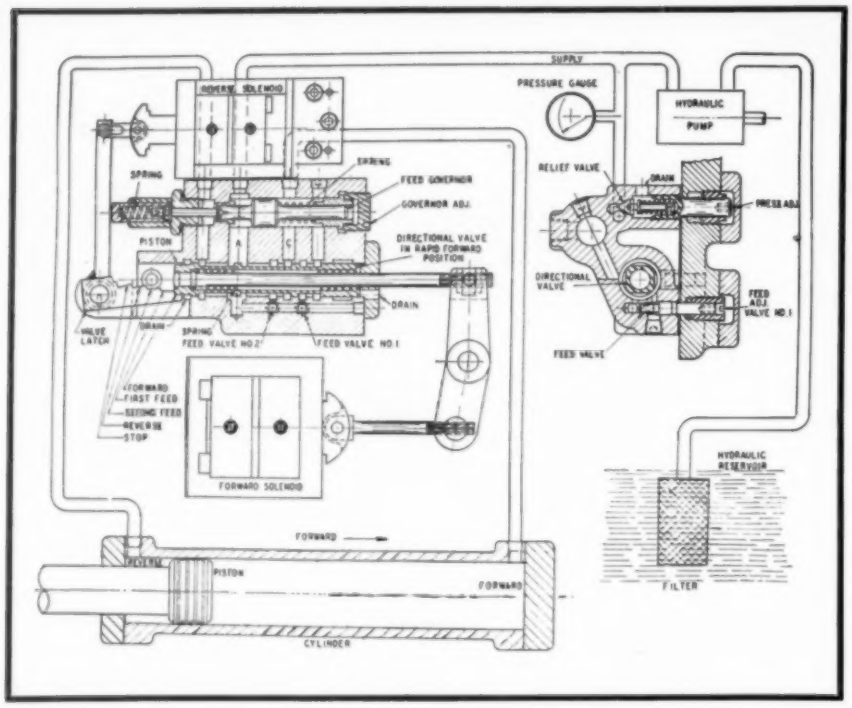


Fig. 3. Arrangement of hydraulic elements for cycle control.

floating screw, flat cams and two platform elevators. The torque applied at each station is independently adjusted to suit the working requirement.

The Natco "Holeunits" are self-contained hydraulic feed unit type drilling heads on the front of which are mounted spindle heads to suit the application. An electric motor, mounted on the rear, drives the spindle head and the hydraulic feed pump.

The main housing is used as the hydraulic oil reservoir and encloses all hydraulic tubing to the system. The ways are lubricated by a piston type pump operated by cam action during the reverse movement of the unit.

A cycle control panel, mounted on the right side of the reservoir, consists of directional control spool-type sliding valves, an offset poppet type relief valve, a feed governor, differential pressure valve, two feed control apertures, electric solenoid for the directional valve actuation and mechanical means required. This unit is a complete control, supplied by a pump and connected to the actuation cylinder.

The actuation cylinder is a 2:1 differential type, which is used as a differential in traverse movement, while in feed only the large or piston end area is used. This arrangement reduces the traverse volume required, allowing the use of smaller pumps.

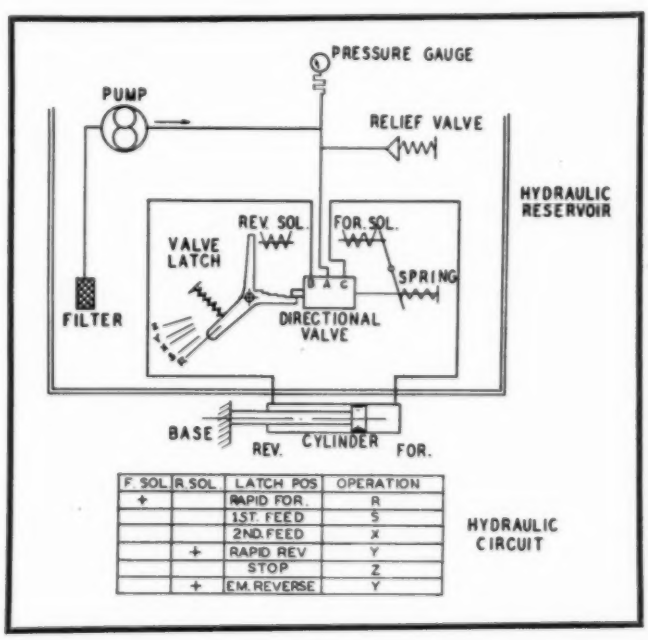
Circuit Control

Rapid Forward: To start a cycle the forward solenoid is energized. The solenoid shifts the directional valve spool to the right (Figures 2 and 3), compressing a spring within the hollow spool. In this position a spring actuated latch engages the spool and holds it in the locked position against the spring pressure.

Fluid pressure from the pump enters the valve at port "A" and is directed by the spool to ports "B" and "C". Port "B" is the rod end of the cylinder and port "C" is the piston or large end. The differential actions cause the unit to traverse forward at a rate equal to the volume of the pump divided by half the cylinder area.

First Feed: As the unit approaches the work, a cam dog operates the latch, moving it one notch and allowing the spring-pressed spool to move one notch to the first feed forward position.

Fluid pressure from the pump then flows through port "A" to port "C" to the large end of the cylinder, while the rod end is opened to the reservoir through port "B". The flow from port "A" to "C" is restricted by an adjustable aperture for feed regulation and a differential governor, which maintains a constant pressure differential across the aperture regardless of the cylinder work



F. SOL.	R. SOL.	LATCH POS.	OPERATION
+		RAPID FOR.	R
		1ST. FEED	S
		2ND. FEED	X
	+	RAPID REV.	Y
		STOP	Z
	+	EM. REVERSE	Y

Fig. 4. Schematic view of circuit control.

load. This action insures a constant rate of traverse idle or under varying load, preventing break through lunge or variation of feed due to change in material or tool sharpness.

Second Feed: When required, a second feed is provided for such operations as counterboring, chamfering or spot-facing. A cam dog, properly positioned, trips the latch one more notch, allowing the spool to travel another step to the left. The flow path is the same as the first feed except that aperture No. 1 is blocked and aperture No. 2 is operative. These apertures are independent, so that the setting of one does not affect the other.

Rapid Reverse: When the reverse point is relatively inaccurate and no finish face is involved, the reverse traverse is accomplished by a cam dog operating the latch, allowing the spool to escape one more notch to the left.

Fluid pressure from the pump enters the valve at port "A" and is directed through port "B" to the rod end of the cylinder. The piston or large end of the cylinder is open to the reservoir through valve port "C".

When accurate depth stop is required before reversal, the valve is reversed electrically through the reverse solenoid.

The feed movement is stopped by a positive abutment and a time period dwell provides clean-up time. Prior to engaging the stop, a limit switch is operated, which sets in motion an adjustable time relay at the termination of the set time. This relay energizes the reverse solenoid and the reverse action takes place as described.

Stop or Neutral: When the head is reversed to the start position, a cam dog operating the latch allows the spool to move another notch to the left.

Fluid pressure from the pump enters the valve port "A" and is directed to the reservoir. Both the cylinder ends are open to the reservoir through ports "B" and "C".

In the stop position a limit switch is contacted. This completes the circuit from the forward start push button to the forward solenoid circuit. When the head moves forward this circuit is broken, so that the rapid forward circuit can not be held in when the first feed cam dog is reached and the head traversed at the rapid rate into the work.

Tapping Units

Natco "Holetappers" are self-contained, individual lead screw tapping units. Tap spindles are driven through conventional type geared heads. The gear box is driven by a reversing type electric motor which is automatically cycled through limit switch and push button control. As a safety feature, a mechanical clutch is provided in the main drive from the motor. This clutch operates only in case of electrical failure. The operating dogs are set to open the clutch if the travel exceeds the limit set by the limit switch operation. The clutch must be reset before operation can be resumed, thus preventing continuous use of the clutch when electrical failure occurs.

The mechanical feed is used in preference to a hydraulic for the tapping operations because feed can be maintained for each individual tap with a minimum of mechanism.

The average production of cylinder blocks per hour means a total of over 4000 separate operations performed. These operations are performed automatically in sequence to limits within the precision requirements of modern automotive cylinder block construction.

This type of equipment, sometimes called transfer machines in the automotive and other high production industries, is characteristic of the newest trend in precision repetitive machining equipment. It is significant that hydraulic power is being used more and more for this type of production equipment; in this case for the operation of the indexing fixture and for all the feed heads except tapping. The adaptability of hydraulic elements, their ability to provide long, trouble-free, accuracy life and their flexibility of arrangement for setup changes and quick maintenance are production advantages that pay off.

Abstracts of Papers at Industrial Hydraulics Conference

The fourth annual meeting of the National Conference on Industrial Hydraulics held at Hotel Sheraton, Chicago, October 20 and 21 heard a total of ten papers, a presentation and discussion of the "J.I.C." — Joint Industry Conference on Hydraulic Standards for Industrial Equipment and received a picture of present industrial conditions in Europe. Mr. R. R. Mitchell, Production Engineering Section, General Motors Corporation, presented the purposes and aims of the standardization movement and Mr. James Robinson, chief engineer, Vickers, Inc., discussed standardization from the viewpoint of the machine tool builders and hydraulic equipment manufacturers. Mr. R. E. Gillmor, vice president of the Sperry Corporation, fresh from a year's study of industrial conditions abroad for the State Department, made an authoritative report in his banquet address, "Our Economic Missions in Europe".

A full report on the "J.I.C." will be made in a later issue.

Four technical sessions were held, each treating a different subject. Recent applications, the subject of the first session, were discussed in two papers.

"The Poly-Phase Torque Converter", *by Oliver K. Kelly, General Motors Corporation, Detroit, Mich.*

Mr. Kelly reviewed the use of the hydraulic torque converter for automobile drives, the first

(Continued on page 18)

AIR CIRCUITS FOR MATERIAL HANDLING

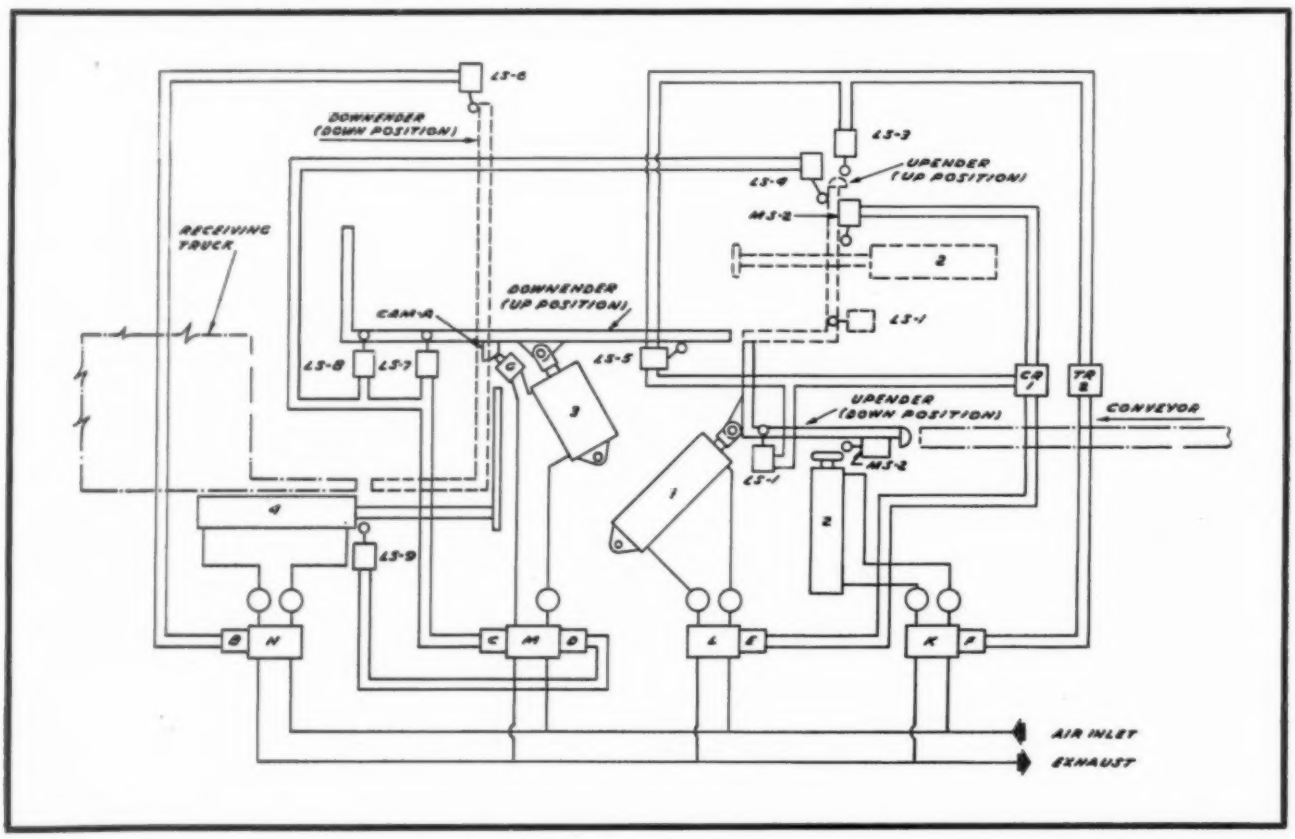
By W. J. SCHUPNER
Design Engineer
Chicago, Ill.

THE VERSATILITY OF AIR CONtrolled equipment is well demonstrated by the "Turnover Stacker", a unit designed as part of the conveyor system in a pulp mill. The function of this unit is to receive single bales of pulp from a power conveyor, turn them over in a stack six bales high, then discharge the stack to a receiving truck. The air circuit employed to accomplish this is based on certain safety features which prevent any part of the machine from operating except in its proper sequence.

The general arrangement of the unit is shown schematically in Fig. 1 and the various steps of its operation will be described in turn.

A bale of pulp is deposited by the power conveyor on the "upender", shown in heavy lines in the "down" position. The bale

Fig. 1. Air circuit for turnover stacker in the conveyor system of a pulp mill.



contacts normally open limit switch LS-1 which is connected in series with LS-5, a double contact limit switch, also normally open and held closed by the "downender" as shown in its "up" position. LS-1, held close by the bale, closes a magnetic contactor or relay CR-1, which, in turn, energizes solenoid "E" on the four-way spring return valve "L". Valve "L" directs air to cylinder No. 1 which pushes the upender upward to the position shown in dotted lines.

As the upender reaches the "up" position, a dog attached to it trips and bypasses LS-3, a normally open limit switch operative in one direction only, which is also connected in series with LS-5. LS-3 upon closing, energizes the coil which closes TR-2, a normally open time delay relay, the action of which is retarded to reopen after fifteen seconds.

TR-2 functions to energize solenoid "F" on the four-way spring return valve "K", which directs air pressure to cylinder No. 2. Note that cylinder No. 2 is attached to the upender and travels with it. As the piston of cylinder No. 2 starts forward, a dog on the end of the rod trips and bypasses MS-2, a maintained contact switch which closes as it is tripped, thus maintaining the holding circuit in CR-1. At this point CR-1 keeps solenoid "E" energized since LS-1 opens immediately after MS-2 closes. The bale is pushed onto the downender, shown in heavy lines in the "up" position.

At the end of the fifteen second setting of the time delay relay TR-2, it opens, thus deenergizing solenoid "F" on valve "K" which reverses cylinder No. 2; the dog on the end of the piston rod opens MS-2, thus breaking the holding circuit in CR-1 which, in turn, deenergizes solenoid "E" on valve "L" and reverses cylinder No. 1. The upender has now returned to its original "down" position.

These operations are repeated until six bales have been pushed onto the downender. As the sixth bale goes into position, the first and second bales close LS-7 and LS-8. These two limit switches are attached to the downender (Figure 1). These switches are normally open and are connected in series with LS-4, a normally closed limit switch held open by the upender in the "up" position. Therefore, as the upender moves down at this phase of the cycle, LS-4 closes to start the operation of the downender.

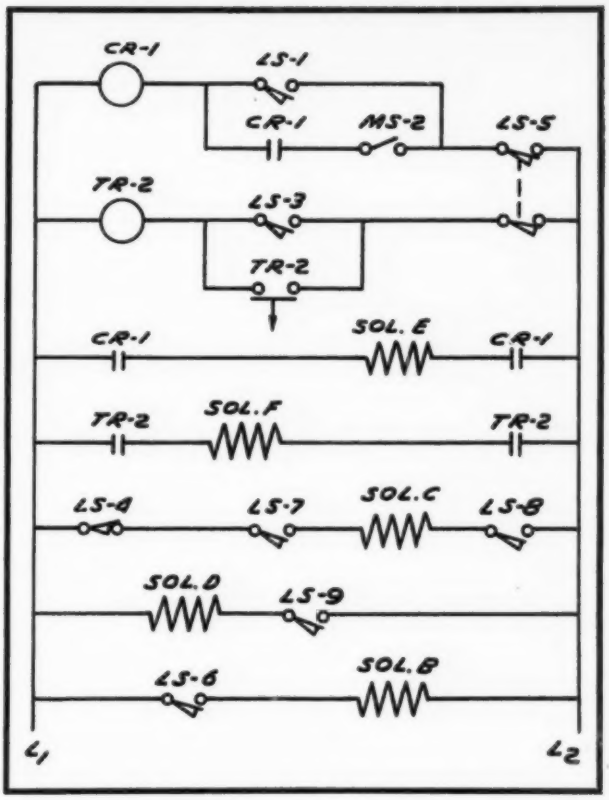


Fig. 2. Line diagram of the electrical pilot circuit.

When LS-4, LS-7 and LS-8 are all closed, solenoid "C" on the double solenoid four-way valve "M" is energized and cylinder No. 3 starts to move the downender with its six bales into final position. However, it is apparent that as the center of gravity of the load, which is being pushed by cylinder No. 3, passes over the pivot point of the downender, it comes under the pull of gravity and would normally tend to "run away". To prevent this, a cam operated valve "G" is placed between the rod side of cylinder No. 3 and the four-way valve "M". Valve "G" has free flow in the direction of the cylinder and controlled restricted flow toward the valve.

A cam "A", attached at the pivot point of the downender, is timed to properly restrict the exhaust air from the cylinder through valve "G". This cushions the load slowly to its "down" position as shown in dotted lines. Note that the downender opens LS-5 on moving away from it, thus cutting out upender operations.

As the six bales reach their final upright position, LS-6 closes, thus energizing solenoid "B" on spring return four-way valve "N" and causing stack-puller cylinder No. 4 to pull the stack of six bales onto the receiving truck. As the bales leave the downender, LS-7 and LS-8 open, deenergizing solenoid "C" on valve "M". The valve spool does not change position; however, since this valve is operated by momentary contact and air still remains on the lower side of cylinder No. 3. Upon reaching the end of its pull stroke, a dog attached to the end of the rod of cylinder No. 4 trips and closes normally open limit switch LS-9, energizing solenoid "D" of valve "M", reversing it and causing cylinder No.

(Continued on page 14)

TRIPLEX CIRCUIT FOR A PRINTING PLANT PRESS

The selection and arrangement of hydraulic and electrical elements for operation and control of three cycles of a matrix press.

By ADAM ZISKA
Consulting Engineer
Wauwatosa, Wis.

A RECENT INSTALLATION OF A 1000 ton matrix press designed for three types of matrix molding required a special arrangement of hydraulic circuit and control to operate the three cycles automatically. The description of the press design has been subordinated in order to more fully explain the reasons for the choice of the hydraulic control components.

A matrix press is used in the printing industries. The main requirements of this press are: it must have practically no platen deflection; it must be simple to operate; and it must be versatile in its operation. The requirement of minimum platen deflection accounts for the deep section of the top platen and for the use of a 28 in diameter single acting ram. The pressing area of the matrix press is backed up by the deep section of the hydraulic ram. The cylinder is held to the top platen by four lowly-stressed bolts. The work is moved onto the pressing area from an external work table by the use of plates mounted on retracting rollers. The press is equipped with electrically heated plates. The heat of these plates is isolated from the press by the use of water cooled platens placed between the press proper and the electrically heated plates.

The motion of this press is controlled by an electrical push button control panel attached to the front of the press. A pressure gauge with adjustable electrical contacts is mounted directly above the electrical control panel. These two units give the operator complete control of the press.

Functions of Cycles

In cycle No. 1, it is required that the machine close rapidly; build up pressure to a predetermined and adjustable tonnage; and then open.

In cycle No. 2, the press closes rapidly; builds up pressure to a predetermined adjustable tonnage; remains closed under pressure for a predetermined and adjustable interval; then opens.

In cycle No. 3, the press closes rapidly; builds up to a predetermined and adjustable tonnage; then slowly diminishes, holding pressure until pressure has dropped to a predetermined and adjustable low pressure; the press then opens.

The electrical and hydraulic equipment on this press is arranged in such a manner that once the operator has selected the cycle, he merely presses the start button and the machine automatically completes the cycle chosen by the operator.

In choosing the hydraulic equipment and controls for this machine, it was essential that the press open and close smoothly and have a gradual and uniform pressure build up. It was also desirable that the hydraulic components be of simple construction and standard design.

The letters used hereafter refer to corresponding letters shown on the circuit diagram, Figure 1.

We have indicated that it was our desire to explain the reasons for the choice of the individual hydraulic control units. In many instances there are several reasons for the choice of the units used. However, we will explain only the main reason for its adaption into the circuit. A 5 hp 1750 rpm motor, "A", was used to drive both pumps. In this circuit, the motor runs only during the closing pressure build-up portion of the cycle. This was done to reduce the electrical input and to increase the life of the pumps. The peak load of 1000 tons will seldom be required, and therefore, a 5 hp motor size was chosen to handle the usual working loads and will be momentarily slightly overloaded during its infrequent use at maximum pressures.

Flexible couplings, "B", were placed between the motor and each pump in order to eliminate possible misalignment of the pumps and motor shafts.

Pump Selections

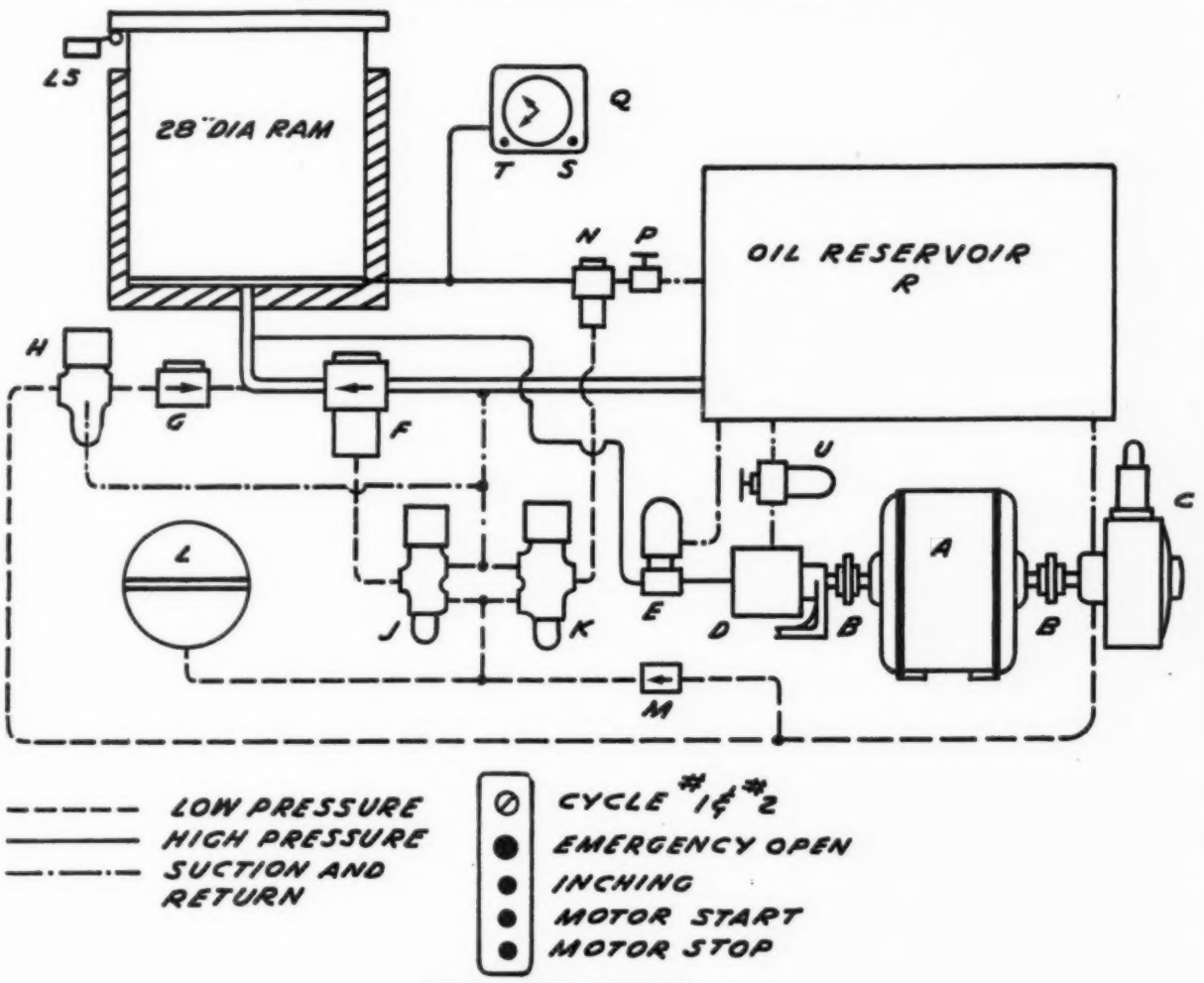
A 24 gpm variable volume low pressure pump "C", is the source of the power used to obtain rapid closing of the press. The variable volume feature is an advantage in that it requires a very minimum of horse power during that portion of the stroke where the high pressure is being built up. Therefore, it does not detract from energy which motor "A" can supply to high pressure pump "D" during the pressure build-up portion of the cycle. Since the pressure of the low pressure pump is not controlled with a relief valve, it consumes very little horse power during the high pressure build-up portion of the cycle. The automatic centering of the pump enables the unit to maintain low pressure without pumping any more oil than the circuit requires.

High pressure is supplied by a 3 gpm piston pump. This pump uses seven hollow pistons and is highly efficient, even under high pressure operations. All pistons are readily accessible without disturbing the piping connected to the pump. Since this high pressure pump is rated at 5000 psi and is required to work at 3200 psi; and since the low pressure pump is rated at 1000 psi and is required to operate at only 200 psi; both pumps operate well under their maximum rated capacity and thus give long uninterrupted service.

To protect the accurately machined parts of the high pressure pump, a suction line oil filter "U" is incorporated.

As a safety feature, a high pressure relief valve "E", is in-

Fig. 1. The circuit for the three cycles in a 1000 ton matrix press.



"A"—5 hp 1750 rpm motor
"B"—Flexible coupling
"C"—24 gpm variable volume vane type pump
"D"—3 gpm radial piston high pressure pump
"E"—Safety relief valve set at 3200 psi
"F"—2 in pilot operated check valve
"G"—1 in straightway check valve
"H"—1 in solenoid controlled pilot operated 2-way valve
"J"—1/4 in solenoid operated 3-way valve
"K"—1/4 in solenoid operated 3-way valve
"L"—Air ballast diaphragm type accumulator
"M"—1/4 in straightway check valve
"N"—1/4 in pilot operated check valve
"P"—1/4 in high pressure needle valve
"Q"—Pressure gauge with adjustable high pressure and low pressure contact points
"R"—Oil reservoir
"S"—High pressure adjustment on Gauge "Q"
"T"—Low pressure adjustment on Gauge "Q"
"LS"—Limit switch

stalled close to the pressure outlet of the high pressure pump. This valve is not used as a pressure regulator. This relief valve has its pressure set at 3200 psi and a cover is placed over the pressure adjusting screw. This cover is locked to the valve body so that unauthorized persons are not able to operate the press beyond its rated capacity.

To obtain rapid closing of the press, this circuit combines the flow of low pressure pump "C" and high pressure pump "D". At the point where the press closes on the work, a simple check valve "G" was placed in the circuit which automatically shuts off the low pressure and allows the high pressure to continue to build up to the desired preset pressure. In order to obtain an inching action on the press, solenoid actuated 2-way valve "H" opens or closes the low pressure line supply oil to the press.

It has been previously stated that electrical and hydraulic efficiency in the circuit was obtained by shutting off the pump motor as soon as the high pressure was reached. In order to initiate the downward action of the press, hydraulic power was required to operate check valves "F" and "N". To supply this power, we incorporated accumulator "L" in the circuit to store up a small quantity of oil under pressure. This accumulated oil pressure is used to actuate the check valves without the necessity of running the pumps during the complete cycle, or of starting them up to obtain the opening of the press.

Control Valves Reduce Piping

Large diameter high pressure piping has been reduced to a minimum by the use of pilot operated check valve "F" which is placed near the press. Low pressure from the solenoid controlled 3-way valve "J", lifts the disk in valve "F", permitting a short and direct exhaust of the oil from the ram to the reservoir; thus giving the gravity return oil minimum of pipe resistance and resulting in rapid opening of the machine.

When pilot operated check valve "N" is opened by the action of solenoid valve "K", it permits oil to flow through a metering valve "P", resulting in a slow pressure drop. Since there is a considerable expansion of the matrix material being pressed and a relatively large volume is displaced by the ram, a simple high pressure needle valve gives the desired pressure drop.

A pressure gauge with electrical controls ("Q" on the circuit diagram) was chosen as a means of pressure control instead of a relief valve. In matrix molding it is necessary to preset the molding pressure before the press is closed, and it is necessary to change this setting frequently. The high and low pressure settings are independent one of the other, and are free moving finger tip adjustments.

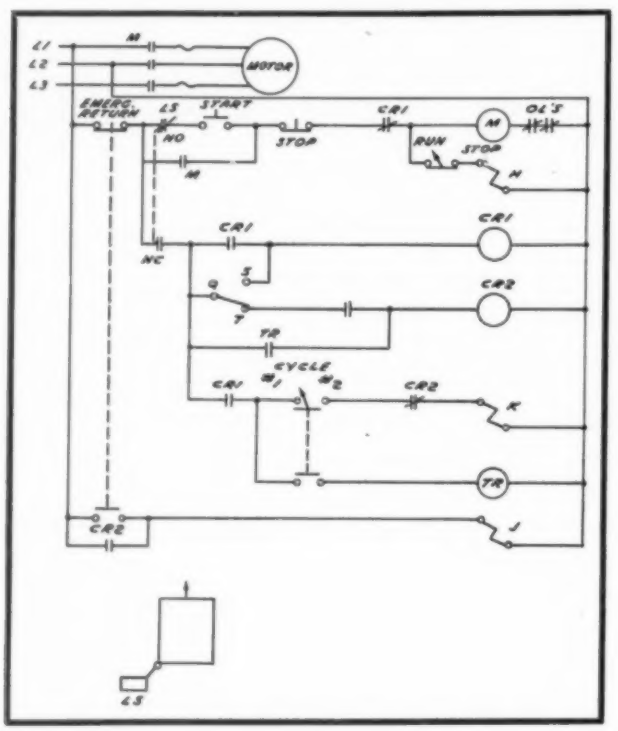


Fig. 2. Wiring diagram for the circuit. The limit switch shown actuated, is relieved when the platen moves up. Contact "T" on the gauge type pressure switch is closed at low setting; contact "S" is closed at high setting.

AIR CIRCUITS FOR MATERIAL HANDLING

(Continued from page 11)

3 to pull the downender to its original "up" position.

As the downender draws away from LS-6, the circuit to solenoid "B" is broken and cylinder No. 4 returns to its starting position. Sufficient clearance is maintained between the receiving truck and the downender to enable the latter to return without interference. The main electrical lines to the pilot circuit of the turnover stacker are connected in series to a master switch (not shown), a precaution observed to render the entire unit inoperative until the receiving truck is in its proper position.

Figure 2 shows a line diagram of the electrical pilot circuit and indicates the comparative simplicity of control design followed throughout the unit.

Piston velocities of all cylinders are regulated by means of speed control valves placed between the air valves and the cylinders. In cylinder loading conditions of this type where the major force is exerted in one direction only, an economy measure to conserve compressed air is often employed; a pressure regulator valve with a bypass check is connected to that end of the cylinder requiring only low pressure to operate it. In cylinders having a long stroke and large diameter the resultant saving in compressor power over a long period of operation may be considerable.

LETTERS to the Editor

Our shop isn't very large but we do have a number of hydraulic machines and this means a number of pumps, valves and accessories including control equipment. We have been pretty lucky about keeping our machines going but we are not handy to any service office of a hydraulic equipment manufacturer and we have had one or two shut down till pumps or parts reached us. We cannot afford to stock a large inventory of hydraulic "spare parts". Can you tell us if a manufacturer has worked out a minimum or emergency kit or stock of parts for some of his small customers?

W.P.

W. P. Letter

Answer:
The manufacturer or manufacturers of the equipment you operate will undoubtedly be glad to work out an "emergency kit" for your specific use. This will depend on the training and facilities of your own maintenance department and on the service policies of the companies involved.

We have a machine driven by a 1½ hp, 1750 rpm motor, reduced by a 5 to 1 gear ratio. This machine which weighs 150 pounds hangs over the heads of workmen. The counterbalance also weighs 150 pounds. Can we run this machine with a remote controlled motor and pump connected with hose and do away with the gears? Our object is to reduce the weight of the machine.

R.H.P.

We are publishing this letter as an invitation to our readers to offer suggestions. Letters or calls will be forwarded promptly.—The EDITOR.

There does not seem to be any coordination between methods used by various manufacturers of fluid motors in rating their units. The engineering data published is not uniform to say the least. For example, one manufacturer builds and designates models by design features, another simply uses the normal developed horsepower as an index of motor size, two at least rate fluid motors in terms of a torque rating in inch pounds for every 100 psi of operating pressure. I have seen some "specifications" that gave no information (to me at least) regarding the performance that might be expected. Maybe this problem is being taken care of by the SAE or ASME hydraulic sections. If it isn't, I believe the manufacturers of fluid motors should get together and at least talk the same language.

J.W.

Answer to J.W.
The Editors invite comments from our readers.

Please send a copy of the index to the articles published in APPLIED HYDRAULICS the first year.

J.F.B.

APPLIED HYDRAULICS is still in its first year and after the publication of our January issue, which will mark the first full year, we hope to have available shortly thereafter a subject and author index covering the first 12 issues. Your name goes at the very top of this index list.

There are a number of high pressure water hydraulic systems in our area. Why don't you publish more of this type of application?

D.P.

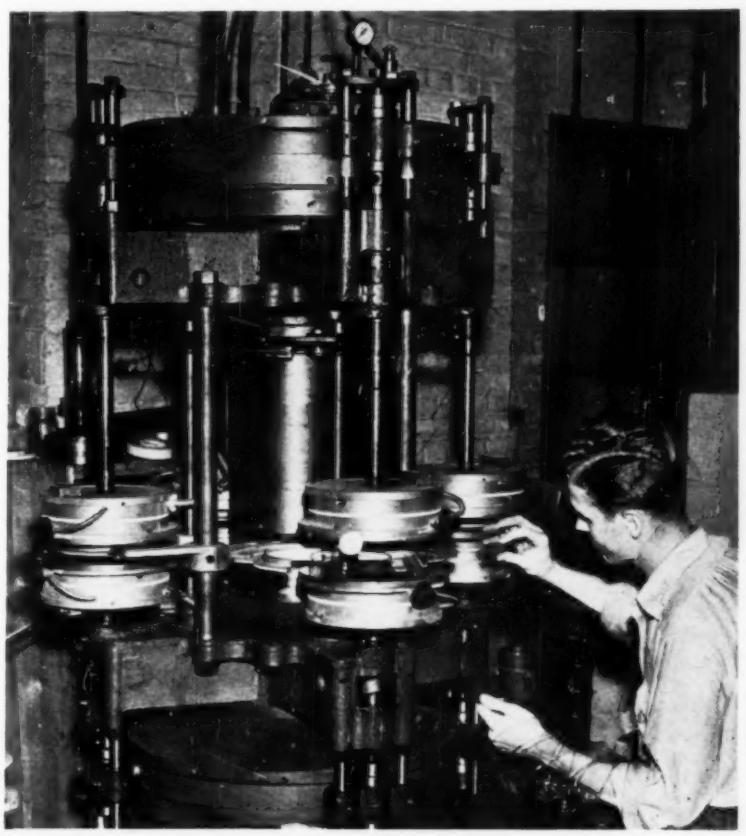
High pressure water hydraulic systems are within our editorial scope and we haven't entirely neglected them. However, let us know where one or several of these jobs are. Better yet, drop us a memo on the essential facts.

Two or three men in our engineering department have been clipping articles from APPLIED HYDRAULICS after the copies have been routed through the organization. We find that there has been some difficulty occasionally when "clippable" articles are back-to-back on the same sheet. Will you kindly print run-overs of articles on separate sheets?

B.L. and H.D.

We will do our best.

This column is open to comments on general trade and technical problems. Comments are invited from our readers on questions or answers as published—EDITOR.



A multi-station, cam operated beading machine, with air ejection, performing an intermediate assembly operation on plastic sheet.

AT TRANSPARENT Specialties Corporation, Cleveland fabricators of plastic sheet, practically every machine in the plant utilizes air, either as the major power source or to operate one or more movements. Most of the forming equipment has been designed and built in the shop under the direction of the plant engineer, Harry Jones. Air cylinders and controls, hydraulic power, electric and electronic units are incorporated into various basic machines for specific production operations. There is a flexibility of set ups which makes it practical to accept short run forming jobs as well as along production runs.

This shop lists the advantages of their air powered machines as: (1) simplicity of set up and operation; (2) adaptability, including the interchangability of units, to a wide range of operations; (3) low first cost; (4) long, trouble-free production; and (5) negligible maintenance.

COLD WAR, HOT WAR, OR NO WAR?

Irving B. Hexter

A FEW weeks ago I had the rare opportunity of spending almost a month with the Mediterranean Fleet as a guest of the Navy. You may imagine that it was a thrill and a most unusual experience.

Among many outstanding things evident on a trip of that kind, I think the most outstanding is the interdependence of Naval operations and American industry. Just because there is no active war being waged, just because factories are not bulging with war orders, it does not mean that the Navy does not need industry nor that industry does not need the Navy.

Because of generations of isolationist thinking, we Americans have a hard time getting used to the idea that our frontiers are in the Mediterranean, or in the Far East, or in South America. Global thinking does not come natural to us yet, but we are gradually getting accustomed to the idea.

Global frontiers mean global protective forces. Global protective forces—the Army, Navy and Air Force—require new concepts in supply techniques, in maintenance methods, in food preservation methods.

Because of political considerations no foreign country in this area may grant us bases for the repair, maintenance or supply of our ships. The best they can do is to let us use some of their harbors a few days at a time. This means, then, that when one of our supply ships starts to transfer supplies it must do it with absolute minimum of confusion and mistakes. Important supplies must be delivered to the right place at the right time, and inasmuch as the Force Fleet is not a static force, but rather, one which moves around from harbor to harbor, this is not always easy.

Inasmuch as our organization publishes magazines in a number of industries, my interest in the operation of the Sixth Task Fleet extended beyond supply and material handling problems, although those are probably the biggest.

The intricate job of supply must be done with the greatest possible dispatch. The job of supplying an entire fleet like the Sixth Task Force (as the Mediterranean Fleet is officially called) from supply ships is one which calls for the most advanced material handling methods. The thousand-and-one things required by a fleet must be kept in ample supply at all times. These are matters that have engaged the attention of readers of one magazine FLOW.

As publishers of INDUSTRY and WELDING, I was much interested in the maintenance operations aboard every ship. Fleet operations, with all the practice exercises and regular sea duties, are wearing on every ship in the force. Without the liberal use of welding, it would be much more difficult, if not impossible, to keep combat vessels at sea for months at a time, unless there was a continuing repair program. And, of course, welding lends itself perfectly to those requirements because it is the perfect maintenance tool.

Because we publish THE REFRIGERATION INDUSTRY, my interest in food preservation was particularly active. The food aboard ship is excellent, qualitatively and quantitatively. Shore establishments cannot hope to supply the vast quantities of food required for a Fleet operation so, again, the supply ship does its stuff. But there is the additional problem of preservation. Again, without refrigeration the operation of the Sixth Task Fleet would be impossible.

The modern combat vessel is one of the most intricate pieces of machinery man has ever conceived. In it are used the latest developments in electronics, hydraulics and pneumatics, subjects of our magazine APPLIED HYDRAULICS. It is a veritable nest of servomechanisms operating everything from the Number 1 gun turret in the forepart of the ship to the rudder mechanism in the stern. Much of our present day development in hydraulics has come from naval vessels and industry is indebted to the Navy for the experimental work which has been carried out in our Arsenal in this whole field.

Wherever there is a naval vessel there are hundreds of Navy men living and working together in comparatively cramped quarters. Inasmuch as a naval vessel is in itself a small factory, the men are subject to all the accident and industrial health exposures of any worker in industry. Whether to protect the men from the excessive use of paint in confined quarters, or from using the lathe in the ship's machine shop, there must be the same industrial safety precautions taken that are found in the most modern plant. As publisher of OCCUPATIONAL HAZARDS that interested me.

Thus, every industry must contribute to keep our ships at sea, our planes in the air, and our troops in foreign trouble-spots. There can be no letup now or in the foreseeable future because it does not look as though there will be any letup in the cold war. I do not believe there will be a hot war.

The greatest reason, in my view, for believing that there will be no war is the fact that we are better prepared for war than we have ever been before in peace time. This fact is the best insurance against war. Traditionally and historically America will not seek war. If we are ready, no other nation will dare to provoke us.

Thus, industry, the secondary defense line of our armed forces, must play a signal and important part in keeping us out of war. Industry must so integrate itself into the needs of our highly technical defense arms that there will be no active war. Industry must help to wage this constant war of preparedness which may cost dollars but will not cost lives or bring the death of our cherished democratic institutions.

Irving B. Hexter

Publisher

ABSTRACTS OF HYDRAULICS CONFERENCE PAPERS

(Continued from page 9)

installation dating back to 1936. At present the torque converter is widely used on busses, tractors and Army tanks and prime movers. The single-phase design employing three turbine stages was the only torque converter in automotive use till recently. The fundamental limitation of the single-phase design is the deterioration of the efficiency when torque multiplication ends. Since a vehicle requires torque multiplication only briefly, such a converter would be disconnected for all cruising. The poly-phase principle produces an efficiency curve which reaches higher values at less torque multiplication, providing a continuous hydraulic drive suitable for automobile use.

"Hydraulic Circuits for Farm Tractors", *by J. F. Ziskal, International Harvester Co., Chicago, Ill.*

Mr. Ziskal showed schematic circuits for various hydraulic power applications to farm equipment. He divided his discussion into two parts: the mounted implement program, in which the hydraulic elements and the tractor become one unit; the trailing implement program, in which the control valve is tractor mounted, and the power cylinder, connected by hose and quick disconnect coupling, is trailer mounted. The developments made in lifting and controlling farm implements were traced and described by series of circuits.

Three papers were presented at the second technical session under the general subject of hydraulic components.

"Flanged Joints—Their Development and the Trend", *by E. G. Schmidt, supervising engineer, Crane Co., Chicago, Ill.*

Mr. Schmidt described recent developments and test work on pressure-sealing types of flanged joints; his data indicating that continued development and improvement is being made. The data presented was secured by means of thermal shock tests on high pressure, high temperature steam. The relationship of such work to the design of commercial hydraulic flanged joints was pointed out.

"Hydraulic Seals and Packings", *by Carl E. Schmitz, vice president and director of engineering, Crane Packing Co., Chicago, Ill.*

Mr. Schmitz presented a comprehensive review and discussion of hydraulic seals and packings. "O" and "V" rings, metallic, woven and cloth inserted packings were illustrated and discussed in terms of construction and services for which each is best suited, including effects of temperature, speed of shaft in rpm and fpm, factors of design necessary for successful performance and recent trends in industry concerning various styles and types of conventional packing materials.

"Gasket Design and Selection", *by H. H. Dunkle, Johns-Manville Sales Corporation, New York, N. Y.*

Mr. Dunkle pointed out that the selection of the combination of materials and gasket construction to create a perfect seal under specific conditions dictates all gasket design. The variables controlling gasket selection were treated in three groups; operating conditions, mechanical features of the assembly and characteristics of the gasket itself. The choice of gasket materials is generally controlled by the operating conditions of pressure and temperature and nature of the confined fluid. The mechanical features of the assembly govern the selection of the gasket construction. The combination of material and construction determines the "sealability" of the gasket and therefore its suitability for a specific installation.

The third session was on the subject of pumps and turbines. Three papers were devoted to this subject.

"Hydraulic Surges in Pump Discharge Lines", *by S. Logan Kerr, consulting engineer, Philadelphia, Pa.*

Mr. Kerr, after reviewing the types of damage caused by heavy hydraulic surges, developed and amplified the Water Hammer Theory on the basis of actual field experience and explained the procedure of predicting water hammer. Such prediction is now an important factor in the design and selection of equipment. He presented analyses which indicated that surges resulting from electric power failures or from ordinary starting and stopping operations are greatly influenced by a number of factors including the velocity of flow, the profile of the pipe line and the physical characteristics of the pipe itself. The type and operation of check valves used under various conditions and the methods of starting and stopping pumping units will affect the hydraulic surge in the discharge lines. Water hammer calculations can be carried out by the use of graphical methods.

"Predicting Liquid Jet Pump Performance", *by R. G. Folsom, University of California, Berkeley, Calif.*

Professor Folsom reviewed the basic principles of the jet pump and explained the importance of momentum considerations in calculating the overall performance of a given unit. He presented graphs of the overall performance of a single unit with a given liquid over any external pressure conditions. A conventional water pressure system consisting of an inner connected centrifugal and jet pump was analyzed and calculations presented to demonstrate the shift in performance to be expected as pipe diameters and lengths are changed and the characteristics of the centrifugal pump are varied. He illustrated the methods used to calculate or predict the operation of the jet pump in any type of installation from basic experimental curves.

(Continued on page 21)

FUNDAMENTALS OF HYDRAULIC MAINTENANCE

By CARL LINDE
Service Engineer
Rockford, Ill.

The second of a series of everyday problems of the maintenance man and procedures for their practical solution.

WHEN A Service Engineer makes his first call at an industrial plant, there are three things he wants to know immediately: (1) what the attitude of the plant maintenance men is toward hydraulic equipment; (2) what hydraulic oil is being used; and (3) how clean the oil in operation actually is.

The answers to these questions are important. They give definite indication to the Service Engineer as to the source of the trouble responsible for his call, since he knows that approximately 75 percent of all hydraulic difficulties stem from incorrect answers to these questions.

The factors involved in the first two questions were discussed in a previous article.* Here we would like to consider the factors involved in the third question.

There is an old saying that "cleanliness is next to godliness". In considering hydraulic equipment, however, cleanliness is not "next" to anything. It is the all-important factor. Hydraulic oil cannot be "reasonably clean" or "almost clean". *It must be clean!*

Obvious? Of course it's obvious. Any maintenance man you talk to will say, "why everybody knows hydraulic oil must be clean". But, like most obvious things, it is the one that is most frequently overlooked or neglected. The proof is the simple fact that unclean hydraulic oil causes more maintenance troubles than all other causes combined.

If you are having any of the difficulties listed below, all of which may be caused or aggravated by unclean oil, much time and trouble may be saved by making the oil the starting point of your checkup.

Scoring of cylinders and valves. Grit or other impurities in the oil may result in the scoring of sliding or rotating surfaces, as well as impairing the smooth functioning of pumps, valves and cylinders. Scoring, of course, causes internal leakage of oil and excessive power consumption, and eventually means a cash outlay for new parts.

Slow machine operation. Oil rendered sluggish through impurities flows more slowly through small ports, orifices and tubing than oil of the correct viscosity; hence it fails to enter the working cylinders in sufficient volume to give the fingertip response for which hydraulic equipment is noted. This deficiency in operation, however slight, may be sufficient to result in lost production due to off-size or inferior finish.

Excessive heating. When impure oil has scored the moving members of cylinders, valves or pumps, the resulting dissipation of pressure through internal leakage without doing productive work quickly causes oil to heat excessively. The result is rapid deterioration of the oil and still more damage to sliding or rotating members.

At this point two questions naturally come to mind: (1) what makes oil dirty?; and (2) what preventive steps can be taken by the maintenance man to keep this trouble to a minimum?

Obviously, one of the first things is to be sure that containers used for storing hydraulic oil are clean. Any reputable manufacturer of oil is extremely careful to insure that there are no impurities in the oil when it leaves the refinery. If properly stored and handled, it will go into the oil reservoir of your machine in that condition.

*pp 25-26, August issue, APPLIED HYDRAULICS.

Dirt finds other ways of entering hydraulic systems. For instance, the atmosphere of any plant is more or less charged with moisture and abrasive dirt. For this reason, air filters or cleaners are an important accessory and no hydraulic system should be without them. Such filters should be cleaned at regular intervals or they cease to be effective safeguards.

In spite of all precautions, chips, filings, threads, lint and other foreign matter are apt to work their way into a hydraulic system. Oil filters in the inlet pipe will remove such foreign matter and prevent serious damage to pumps. These filters, too, should be cleaned at regular intervals to prevent clogging and consequent reduction in the volume of oil reaching the pumps, and to prevent cavitation.

Examination of an oil reservoir frequently discloses gummy deposits. These deposits are often caused by the deterioration of the oil due to dirt in the system. This is not always the case, however. For example, in a system using flexible hose connections, the rubber linings of the hose may decompose under prolonged exposure to warm circulating oil, producing gummy, clogging deposits. Or an inferior paint on the inner walls of the reservoir may soften and flake under continued exposure to warm oil, also resulting in the formation of gummy deposits.

Other possible sources of contamination are lubricating oil, grease and coolant. Frequently trouble caused by lubricating oils or compounds used on the ways of machines may be eliminated by using a lubricant of the same high quality as the hydraulic oil. Trouble from grease may be minimized by using a high quality grease and using it sparingly. It is sometimes difficult to keep coolant from entering a hydraulic system. However difficult this may be, it is of the utmost importance that this is done. Otherwise pumps, sensitive valves and controls may easily be damaged beyond the possibility of repair.

If you use an oil cooler, you have a fine possible source of trouble from leaking tubes or coils. Such trouble will show up through a rapid emulsification of the oil. The remedy, of course, is to check the cooler carefully for water leaks.

Occasionally a maintenance man is surprised to find that a deposit which he has labeled oil sludge is actually nothing of the sort. It is iron oxide or rust. It so closely resembles oil sludge that a chemical analysis often is required to identify it. Rust is proof positive that a hydraulic system has or has had water in it. The remedy is to locate and eliminate the source of water contamination.

When gummy deposits or emulsification interferes with the proper functioning of a hydraulic system, it may be necessary to shut down the machine and clean the reservoir. Often, it is sufficient to drain the reservoir and flush the entire system with a good clean hydraulic oil.

If simple flushing is not sufficient to remove the deposits, it may be necessary to use a more active solvent. Such solvents should be used with care and only when the maintenance man is certain that flushing under pressure with a solvent will not damage the pump because of the lack of lubricity. If there is any question as to whether or not damage will result, it is far wiser to dismantle the unit and wipe or scrape the deposits from valves, ports and sliding or rotating surfaces.

Never use waste, either cotton or wool, to wipe the inside of a hydraulic reservoir or the component structures of a hydraulic system. If cloth must be used, be sure it is free of lint. A better and usually available drying agent is compressed air.

Suggestions for Care and Handling of Hydraulic Oil

1. For precision results, use the hydraulic oil recommended by the manufacturer of your equipment. He knows what he is talking about; it has cost him real money to find out.
2. Never try to economize by using an inferior grade of oil. Any apparent saving will be lost many times over in down time and repair costs.
3. Always use clean containers for storing hydraulic oil.
4. Check your oil often, and change whenever it shows signs of deterioration. The expense of the best hydraulic oil obtainable is negligible compared to a repair job costing several hundred dollars plus the loss of time and income.
5. When new oil is put in the reservoir, it should always be poured through the strainer in the oil filler opening. It is good practice to clean this strainer thoroughly before adding new oil.
6. Be sure all filters are cleaned often and replaced tightly.

SAVE THIS VALUABLE REFERENCE MATERIAL: BUILD UP A PERMANENT FILE

HYDRAULIC ABSTRACTS

(Continued from page 18)

"Recent Developments in Hydraulic Turbine Design and Manufacture", *by J. F. Roberts, manager, Hydraulic Department, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.*

Mr. Roberts confined his presentation to the design and construction of large hydraulic turbines, special attention being given to those with ratings from 10,000 hp to 125,000 hp. He stressed the great advances made in the welding of plate steel spiral casings, some with thicknesses up to 2-5/16" for operations under heads up to 435 feet. He described casings on which both shop and field joints were welded without stress relieving by annealing. Case histories cited no weld failures after 3 to 5 years of operation. Other intricate turbine parts such as cover plates, discharge rings, speed rings, Francis runners and impulse wheel buckets have been fabricated out of welded steel plate. There also has been an increase in the use of stainless steel to resist pitting, erosion and corrosion, resulting in reduced maintenance costs. Newly designed self-lubricating bearings and carbon ring seal rings have simplified operation and have eliminated sources of trouble and failure.

The fourth technical session was devoted to servomechanisms. Two papers were presented.

"Industrial and Commercial Application of Hydraulic Servomechanisms", *by Walter Ernst, vice president for engineering, The Commonwealth Engineering Co., Dayton, Ohio.*

In this paper Mr. Ernst presents a historical survey of servomechanisms from their invention in 1871 and discusses the original application to relay governors for steam turbines. Applications to the control of variable delivery radial and axial hydraulic pumps were discussed and illustrated. Rotary hydraulic transmissions controlled by servos were described. A description of hydraulic steering of ships and automatic vehicles and the development of precision servos and automatic tracer mechanisms on machine tools completed the historical survey. The two methods — transient and frequency response — were discussed and the behavior of linear servomechanism with proportional control was analyzed both for ideal conditions and inclusion of elasticity and leakage.

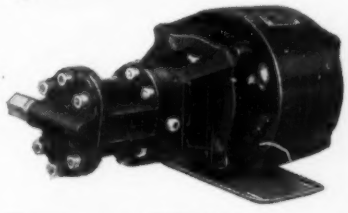
"Measurement of Hydraulic Machinery Performance As It Pertains to Servomechanisms", *by Donald P. Campbell, Massachusetts Institute of Technology, Cambridge, Mass.*

Professor Campbell divided servomechanism systems into three groups: sensitive measuring instruments, amplifier-stabilizers and power converters, some or all of which may be hydraulic. Hydraulic pumps and motors used separately or combined as variable speed transmissions can be power converters. Hydro-mechanical feedback systems of valves, pistons and linkages can be amplifier-stabilizers. Balanced vanes, jet pipes and spring loaded diaphragms under fluid pressure can be measuring instruments. The physical behavior of pumps, motors, transmissions and follow-up devices can be predicted by the frequency response method. Frequency response tests on hydraulic machines are often difficult to make because of the complicated test apparatus. Actual measurement of data is an easy procedure; data is easy to interpret and to represent. The task of the designer becomes one of selecting elements with specific frequency response characteristics; to form practical closed-loop systems then becomes a matter of choosing correct combinations of mechanisms in terms of their functional performance.

Problem:
to cut down on pump failures in moving fluids.

Solution:
Specify long-life, dependable pumps by Eastern

Built to stand the gaff of long, multiple-cycle non-lubricating liquid pumping, Eastern GW Series Pumps operate efficiently and economically. They're quiet, consume little power and deliver uniform performance day in and day out.



The Eastern GW Series is precision-built in two sizes: GW-1, rated at ½ G.P.M. and GW-2, rated at 1 G.P.M. — against pressures up to 200 P.S.I. — plenty of pumping power and volume for normal liquid transfer applications.

CHECK THESE FEATURES

Stainless steel drive gear; graphite carbon composition driven gear; no metal-to-metal contact; graphite impregnated bearing; hydraulically balanced; lifetime stuffing box mechanical seal; tough bronze construction.

You can get immediate deliveries on both Eastern GW Series Pumps. They are supplied with 1/6 or 1/4 H.P. motors; belt driven or flexible coupling driven units are also available.

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New PRODUCTS

For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Air Cylinders

Improved threaded head air cylinders with adjustable cushion unit are available from Modernair Corporation. They are particularly desirable for applications that require a variable speed for the cushion stroke. This adjustable cushion unit can be secured as an accessory for models already in use or it can be installed on new models. The threaded head cylinders are available in full - cushioned, semi-cushioned or non - cushioned models in 2 to 6 in diameter bores. Use Business Reply Card, mark NP-1.

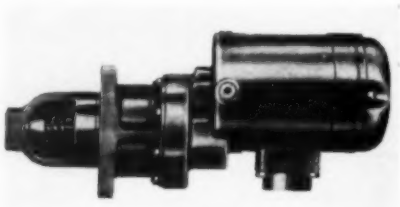
Hydraulic Gauge

A. Schrader's Son, Division of Scovill Manufacturing Company Incorporated, announces a

new hydraulic dial gauge. It employs an ingenious adaptation of the direct action principle incorporated in the other gauges made by this company. The new gauge is made in 9 pressure ranges; the lowest range is from 5 to 50 lbs and the highest is from 500 to 5000 lbs. The large clear calibrations can be read at a distance of 50 feet. Use Business Reply Card, mark NP-2.

Air Cranking Motors

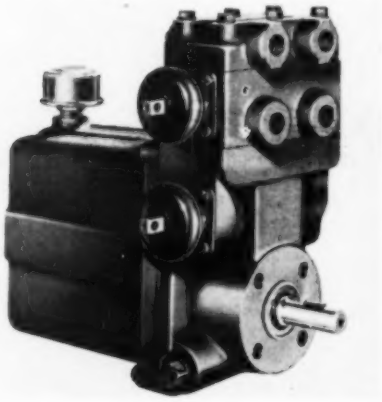
The Leece-Neville Company announces a new air cranking motor for quick, dependable, low-cost starting of diesel and



gasoline engines. A 20 cu ft storage tank at 150 psi will give 30 seconds cranking. Maximum permissible pressure is 250 psi. This starter is recommended for use in the presence of flammable liquids or combustible atmospheres. Use Business Reply Card, mark NP-3.

Hydraulic Power Pack

The Hydraulic Power Pack, a package unit with vane type pump, relief and operating valves, tank and mesh screen type filter, is available from Vickers Incorporated. The unit, originally developed for power operation of farm machinery, is finding many applications in industrial equipment including



automotive, construction machinery, textile, steel and others. A universal mounting provides flexibility for belt, chain, gear or direct drive. Power driven, this unit develops 4 hp input at 1200 rpm and 1,000 psi. Valves for operating any number of single or double acting cylinders or combinations thereof, are available. Bulletin No. 46-48A gives details of features, specifications and performance. Use Business Reply Card, mark NP-4.

Pressure Pickup Fitting

A new pressure pickup fitting, featuring a positive "O" ring seal and a quick method of attachment is announced by Statham Laboratories, Inc. Bulletin No. 500 gives exploded and assembly drawings, specifications and prices. Use Business Reply Card, mark NP-5.

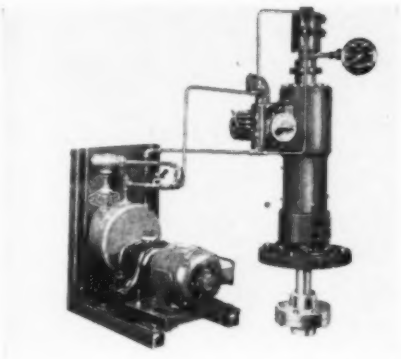
Air Hoist

A new line of safety air hoists is announced by Miller Motor Co. Equipped with three position valves, the circuit exhausts on the up-stroke only. The hoist will not drop its load in the event of line breakage or supply failure. Precision-built for long service and minimum maintenance, the hoist is available in bore sizes ranging from 3¼ to 14 in, strokes of 36 in or more, with or without plain or swivel hook. Full data is available in circular File 258. Use Business Reply Card, mark NP-6.

Variable Speed Hydraulic Drive

A line of application-engineered hydraulic drives is in production at the Hydraulic Division of Rockwell Manufacturing Company. The system uses both pumps and motors of Rotocycle design, features of which are large volume displacement, quiet, non-pulsating operation and high efficiency, Motors may be remotely located from pumps and several motors can be supplied from one pump. A predetermined speed is maintained through a separate hydraulic control circuit that operates on

the principle of constant pressure differential through a pilot valve. This "Hydro-syn" system can be used to maintain any predetermined speed, torque, pressure, volume or liquid level. Use Business Reply Card, mark NP-7.



Air Control Valve

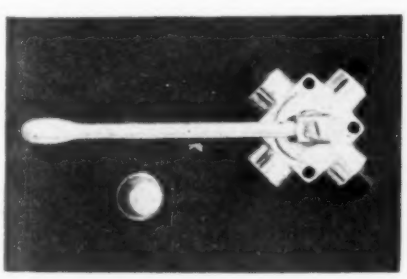
The three-four-way Master Air Control Valve for air cylinders is announced by the Valley Tool Co. Balanced piston design eliminates the need for a lapped fit. Used to actuate the molded oil-resistant slide valve, various applications may be made by adding accessories for hand or foot operation with neutral, reciprocating solenoid or remote poppet. Use Business Reply Card, mark NP-8.

Hydraulic Power Unit

Phillips - Drucker announces their "Power Demon" hydraulic power unit, a single assembly pump, valve and tank. The unit is available in sizes 5 to 20 gpm for operating pressures up to 1200 psi. Use Business Reply Card, mark NP-9.

Control Valve

A 4-way control valve, developed expressly to meet the newly proposed Army and Navy specifications for 3000 psi aircraft systems, has been announced by General Automotive Supply Company. The unit has a handle torque of 18 in-lb or less and a leakage of 5 drops per minute under 3000 psi service. The valve is simple, inexpensive to fabricate and can be used wherever 4-way control is desired. Use Business Reply Card, mark NP-10.

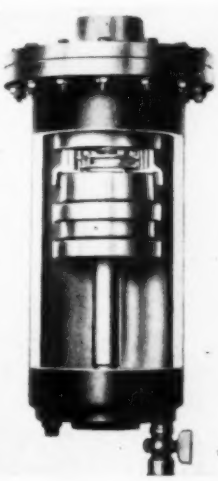


New Time Delay Unit

The DiaPHlex Division of Cook Electric Company announces a new time delay unit, the "Tarrytron" with settings available from one second to two minutes. Stable in operation and with heater currents that can be ranged from 6 v to 115 v, ac or dc, the new unit is interchangeable with similar time delays for wide application in aircraft and industrial fields. A supplementary miniature relay is available where continuous duty and heavy currents are encountered. Use Business Reply Card, mark NP-11.

Air Separator

A new compressed air centrifugal separator, Model "E", is offered by Chicago Manufacturing & Distributing Co. It removes oil, water, dirt and rust. There are no moving parts, no adjustments are necessary and they are strictly mechanical in operation requiring only the draining off of the moisture. The unit has a capacity of 250 cfm, is 8 in diameter and has standard pipe connections of 1½ in. Units of smaller capacity are also available. Use Business Reply Card, mark NP-12.



Air Hose

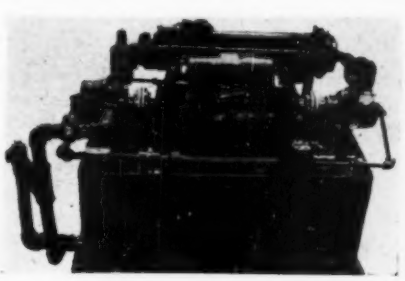
The B. F. Goodrich Company announces their new light weight, extremely flexible "Highflex" air hose. The hose, designed for pressures to 250 psi, is available in sizes ranging from 3/16 to ½ in. The hose is oilproof, nonswelling and nonflaking and is reinforced by a single ply, double braid. The outer cover is an extra tough sheath of bright red rubber. Use Business Reply Card, mark NP-13.

Solenoid Actuator

A new push and pull, continuous operation solenoid actuator is announced by Phillips Control Corporation. With a maximum stroke of 1 in at 115 v, 60 cycles and approximate pull of from 2 pounds at ¾ in to 4.2 pounds at ¼ in stroke, the new actuator has precision ground faces, nonmagnetic stainless steel side plates on the plunger and a frame of bonded silicon steel laminations. Use Business Reply Card, mark NP-14.

Dual Pumping Units

Both low and high pressure dual pumping units are now available from Universal Hydraulic Machinery Co. The pumping units are reservoir mounted with relief and unloading valves, double-end motor and oil cooler. Combinations from 12 to 40 gpm at 250 to 500



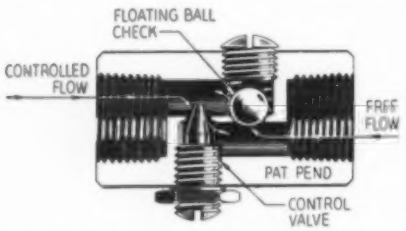
psi with gear pumps and 1.25 to 5 gpm at pressures up to 5000 psi with radial piston pumps are offered in this line. Use Business Reply Card, mark NP-15.

Unloader Pilot Valve

Plain and strainer type pilot unloader valves for air compressors are offered by R. Conrader Company. These valves are used for delivering instantaneous receiver pressure to the unloading device to unload the compressor and to load up the compressor at predetermined minimum receiver pressure. The cycle is repeated as pressure rises and falls. They can be adjusted to from 3 to 30 percent of receiver pressure. Use Business Reply Card, mark NP-16.

Flow Control Valve

A unique flow control valve for air or hydraulic cylinder speed control is available from Pneu-Trol Devices, Inc. It features speed plus unrestricted flow from the cylinder and is



compact in size—only slightly larger than pipe size. The valve is available in four sizes ranging from ⅛ to ½ in with a brass body being used for service to 1000 psi and a steel body for service to 5000 psi. Use Business Reply Card, mark NP-17.

Air Compressor

An air compressor that can be enlarged to meet expanding requirements has been announced by Air-Flo Compressor Co. The new basic compressor uses 18 principal parts to construct 48 different models of cylinder pumps in single or two stage types. It is possible to purchase the size immediately needed and as requirements expand, additional parts can be obtained to increase the capacity. Vertical, V-type or side angle construction is possible. Use Business Reply Card, mark NP-18.

Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

26. Positioning Control System . . . The General Electric electronic positioning control system for industrial applications is described in 8-page bulletin GEA 4760 issued by the Apparatus Department, General Electric. Designed for either manual or automatic control, the system can control opening, closing and adjusting of valves, the positioning of heavy work in machine tools, remote or inaccessible dampers or any other mechanical parts. The system consists of a master control station, an electronic control panel and a follow-up device. The system is easy to install, operate and service.

27. Lubricator Valve . . . The Grannan lubricator valve for single line centralized lubrication systems is fully illustrated and described in a 8-page booklet just published by Titeflex, Inc. Fully hydraulic in action, each lubricator positively delivers the correct predetermined discharge to each bearing.

28. Double-Pole Double-Throw Switch . . . A double-throw, double-pole precision snap switch constructed with a hammer-blow type of actuation is described on Data Sheet No. 47A now available from Micro Switch Corporation. The construction gives simultaneous make and break of two separate circuits. It may be used as an interlock switch for the control of two isolated circuits carrying different electrical ratings.

29. Leather Packing Brochure . . . A new brochure on hydraulic and pneumatic leather packings has been issued by Chicago Belting Co. Cup, flange, "V" packings, vacuum and air cups are shown as well as mechanical leathers. Specifications and price lists are included.

30. Air Hoists . . . Bulletin A-4-B, issued by Curtiss Pneumatic Machinery Div. of Curtiss Mfg. Co., gives full description and technical data on the air hoists, air cylinders, air valves and speed control boxes made by this company. The full line includes all standard classes of single and double-acting hoists and bracketed air cylinders.

31. New Industrial Solenoids . . . Bulletin 481, describing the new line of industrial solenoids made by Detroit Coil Co. is being distributed to the trade. Three models with maximum stroke of one-half inch in both push and pull types are available. Specifications and sketches of mounting plates are shown.

32. Valve and Hose Couplings . . . Quick-As-Wink valve and hose couplings produced by C. B. Hunt & Son, Inc., are shown in their Bulletin No. 104-B. Designed for air applications, the valve couplings are offered in sizes ranging from ¼ to ¾ in, and the hose couplings in sizes from ⅛ to 4 in. Also included are hose nipples and hose clamps. Design drawings, complete parts and specifications are included.

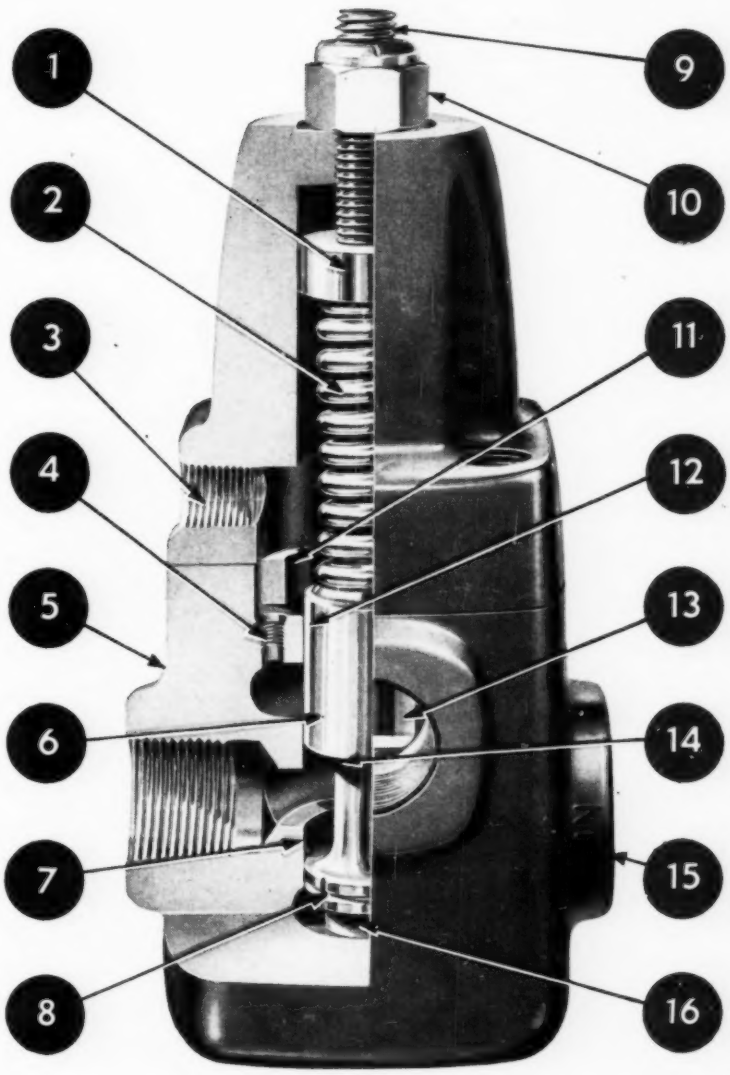
33. Fluid Handling Pumps . . . The Yale & Towne Mfg. Co., Pump Department reviews the line of fluid handling pumps they produce in a booklet comprising a group of descriptive folders and general engineering data. Rotary piston, positive displacement pumps for numerous applications are described and construction and application details are shown. The engineering data section is as-

(Continued on page 26)

WHAT A RELIEF!

GEROTOR develops chatter-free hydraulic relief valve

It's here—a new Gerotor relief valve that makes chatter a thing of the past! Improved design throughout (see details below) assures highest efficiency. Coupled with Gerotor control valves, cylinders, motors or pump units, this Gerotor relief valve protects hydraulic systems against pressure overloads.



1. Spring guide (available with "O" ring seal when valve incorporates hand-wheel adjustment).
2. Spring (available in two sizes, for 50-300 and 50-1500 p.s.i.).
3. Spring chamber external-drain port, normally plugged; connected to tank when used as sequence valve.
4. Spring chamber internal-drain port, normally open; plugged when used as sequence valve.
5. Gauge port (not shown) provided for on side opposite exhaust port.
6. Hardened, ground and lapped plunger.
7. One diameter bore permits accurate fitting of valve plunger.
8. Oil channel.
9. Pressure adjusting screw.
10. Self-sealing locknut design eliminates lost valve caps.
11. Piston stop (not shown) incorporated when ordered for sequence valve service.
12. Large piston bearing surface.
13. Exhaust port 90° turned in relation to pressure line.
14. Large diameter plunger, with full area exposed, permits close differential operating characteristics.
15. Pressure ports permit in-line piping arrangement.
16. Dash pot provides CHATTER-PROOF service.

GEROTOR

hydraulic valves

Write for Catalog Section 201

GEROTOR MAY CORPORATION, BALTIMORE 3, MARYLAND

sembled for the sole purpose of assisting in solving pumping problems and facilitating successful operations.

34. Rotary Air Pumps . . . The air and water cooled rotary air pumps produced by The Kraissl Company Incorporated. They are designed for suction and positive pressure applications. with capacities to 75 cfm. The units are base-mounted assemblies complete with automatic lubricating system, coupling and electric motor. Two type designs are available — roller displacement and multi-blade rotary displacement.

35. Sunvis 900 Oils . . . A new illustrated booklet is available from Sun Oil Company describing the characteristics and applications of their Sunvis 900 Oils. These oils are premium grade, paraffinic-type turbine oils, specially processed to resist deteriorations and give the highest protection against corrosion of bearing surfaces and the rusting of ferrous metals. Typical pieces of industrial equipment ranging from large hydraulic presses to textile spindles are shown as typical applications. One section is devoted to the step-by-step refining processes in the manufacture of this type of oil.

36. Industrial Catalog . . . Catalog No. 350 issued by The Imperial Brass Manufacturing Co. contains the full line of tube fittings for oil, gas, air and hydraulic installations, tube working tools, valves, strainers and other products manufactured by this company. A very complete list of fittings and accessories are shown.

37. Air Cylinders . . . Catalog 91, issued by Logansport Machine Co. Inc., covers the standard stationary and rotary air cylinders and air-operated vises in their line. The stationary double-acting cylinders are available in sizes from 1½ to 16 in bore, any stroke to 18 ft in 1½ to 8 in bore and any stroke to 10½ ft in 10 to 16 in bore sizes, for operating pressures to 150 psi. All models are furnished in 7 mountings, without cushioning or cushioned at one or both ends. Three models of rotating air cylinders and both adjustable and fixed-jaw air vises are shown.

38. Rubber Goods . . . The industrial and mechanical rubber goods available from Lavelle Rubber Company are reviewed in their technical handbook and Catalog No. MS46. Of special interest are the "O" and cord rings offered for hydraulic applications. Also available are a complete line of molded, extruded, lathe cut and punched rubber products and die cut fabrications. The handbook is profusely illustrated with dimensional drawings. There are very useful charts on the characteristics of the major rubber compounds and on the stock of sheet and slab stock.

39. Electric Motor Selection . . . Allis-Chalmers has prepared a handy guide for selecting the motor that incorporates the electric or mechanical characteristics desired. Squirrel-cage motors, wound-rotor motors, synchronous motors, direct current motors and gear motors are reviewed. Also included are sections on NEMA motor specifications and dimensions, motor controls and starters. Charts, graphs and photographs are used throughout.

40. Valves . . . The 48-page catalog issued by Homestead Valve Manufacturing Co., illustrates and describes the line of valves made by this company. Included are high and low pressure hydraulic operating air valves. They are made in 3 and 4-way designs with patented "protected seat" for both 1500 and 3000 psi working pressure. Both 3 and 4-way remote control hydraulic operating valves are also shown.

41. Air Cylinder Selector . . . A new air cylinder selector and pneumatic calculator in the form of a slide rule has been prepared by Hanna Engineering Works. By using this calculator it is possible to easily find cylinder diameter, required gauge pressure, force, pipe size, cycles per minute, pressure drop, etc. Conversion factors, friction correction factors and necessary instructions for use are printed on the rule itself. In addition a detailed operation sheet is included with each one.

42. Mechanical Leather Packings . . . The design and application of mechanical leather packings is covered in a handbook recently published by Mechanical Leather Packing Division of American Leather Belting Association. Standards published in this handbook were adopted through the cooperative efforts of the manufacturers of mechanical leather packings. Cup, U, Vee and flange leather packings and leather washers, gaskets and diaphragms are included. There are sections on service hints, installation and maintenance of leather packings. Excellent drawings and complete specification charts are used throughout this handbook.

43. Centrifugal Air Cleaner . . . Logan Engineering Co. has issued Bulletin No. 147 describing the Aridfier which operates by compressed air. Alternately rotating rotors, mounted on ball bearings, remove moisture, dirt and oil from the air. Installation sketches and application photographs are shown.

44. Safety Valves . . . New Catalog No. 26 on safety valves has been issued by Kunkle Valve Company. Featuring a high pressure liquid relief valve—for pressures to 2500 psi and sizes ½ to 1 in—and a similar valve for air or gas service, the catalog lists the complete line of pop safety and relief valves made by this pioneer manufacturer. Full specifications are given for each type of valve.

45. Air Compressors . . . The single and two-stage rotary air compressors produced by Fuller Company are described in detail in Bulletin C-5. These compressors, incorporating multivane construction, are available with base type intercooler or sepa-

rate intercooler for service to 120 psi. Complete construction and detail drawings and specifications are included in this bulletin.

46. Cylinder Packing . . . Bulletin No. 4502, issued by Darling Valve & Manufacturing Co. describes the Darcova Pumcups for packing pistons of air and hydraulic cylinders as well as reciprocating pumps. Used for many years in the oil industry, the Pumcups are built to tolerances of .005 in, decrease fluid slippage and increase packing life. A number of application photographs and engineering data are given. Bulletin No. 4401, by the same company, is devoted to applications for pistons of reciprocating pumps. Either or both Bulletins are available.

47. New Pump Catalog . . . New Catalog J, issued by American Engineering Co., gives complete engineering data on the Hele-Shaw radial-piston pumps, pump controls, differential valves, pumping units and hydraulic pipe testing machines made by this company. The range of sizes in the high pressure pumps has been extended to 120 gpm (the range begins at 3¾ gpm and includes 10 sizes); low pressure pumps are made in five sizes from 7½ gpm to 66 gpm.

48. Formed Felt Filter . . . American Felt Company's Data Sheet No. 15 gives technical information on the felt filters made by them. These are widely used for hydraulic oil filtration. Performance characteristics, selection and recommended uses for each of the eight standard filter felts are given.

49. Time Delay Relay . . . The Model 308 time delay relay, in two types, is reviewed in Bulletin No. 770 prepared by The Partlow Corporation. One type contains a normally closed load switch and the other type a single pole-double throw load switch. These units are totally enclosed and are offered in four timing ranges from 0 to 5 hours.

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Greer Hydraulics, Inc., will open a branch office in Dayton, Ohio, to establish and maintain closer customer and representative contacts in the midwest territory. Sumner L. Barton will be in charge of the new office.

Hydro-Line Manufacturing Co., Rockford, Ill., has appointed Rogers and Baxter, 2013 Olive St., St. Louis, Mo., as exclusive representatives for air and hydraulic cylinders and special machinery in the territory including southern Illinois, Missouri, Iowa, Nebraska, Kansas and Oklahoma.

Rudel Machinery Co., New York industrial equipment distributor, has appointed J. E. Baxley to its staff as hydraulic engineer. Baxley will specialize in the products of the Logansport Machine Co.

Hydraulic Equipment Company, Cleveland, will exhibit an operating model of a typical industrial hydraulic control system at the Materials Handling Exposition in Philadelphia, January 10-14. Full-scale plastic elements including double-acting cylinders, pump and control valves will be demonstrated. The new Hydreco "Four-Bolt" hydraulic gear pump will also be shown. C. F. Rayment, sales manager, will be in charge of the exhibit. Other representatives of the company who will be in attendance include R. A. Andrews, E. C. Davis, R. F. Hodgson and C. L. Paxton.

Cutler-Hammer Inc., Milwaukee, has purchased West Electric Products Co., Los Angeles. The plant will be integrated with other Cutler-Hammer units in the manufacture of motor controls and allied electrical equipment.

Jas. P. Marsh Corporation, Skokie, Ill., announces the acquisition of the Witt Gauge Division of National Pressure Cooker Co. The acquisition will broaden the large Marsh line. The identity of the Witt line will be preserved; Witt gauges will be produced in the Marsh plant, a new, ultra-modern structure.

Saval, Inc., manufacturer of hydraulic controls at Los Angeles, Calif., announces the setting up of three offices for engineering service. The offices are equipped to take care of all customer contacts. J. E. Flickinger is western manager of engineering with offices at the Saval plant, 1915 E. 51st St., Los Angeles. Charles E. McQuan is midcontinent manager with offices at 35 Reserve Bldg., Wichita, Kans., and Bruno C. Reciputi is eastern manager with offices at 62 N. Franklyn St., Hempstead, L. I., N. Y.

The Pesco Products Division of the Borg-Warner Corporation has opened a new district sales office at 231 S. LaSalle St., Chicago, Ill. J. D. Campbell will be in charge of the office, assisted by C. B. Maple, Jr., both of whom were trained at the home office in Cleveland.

Purolator Products, Inc., Newark, N. J., on the occasion of reaching their 25th anniversary, published a handsome illustrated brochure outlining the history of the company and tracing the development of their products during this period.

The A. W. Nash Company, 5225 Wilshire Blvd., Los Angeles, Calif., has been appointed southern California representative by the Ajax Flexible Coupling Co., Inc.

Linear, Inc., Philadelphia, has appointed Haskel Engineering & Supply Co., Glendale, Calif., as their sales representatives in southern California.

Power Plus Products Company, Detroit, Mich., announces the appointment of Dean W. Johnston as manager of sales and distribution and of Elwyn Kaake as chief engineer in charge of engineering and production. Mr. Johnston was formerly sales manager of the Hydraulic Division of The New York Air Brake Company and Mr. Kaake was formerly on the engineering and production staff of Hydraulic Machinery, Inc.

Watson-Stillman Co., Roselle, N. J., manufacturers of hydraulic equipment, have recently celebrated their one hundredth anniversary.

Dudco Products Company, Hazel Park, Mich., announces that the U. S. Hoffman Machinery Company of New York City and Syracuse, N. Y., will manufacture, on an exclusive royalty basis, the Dudco vane-type motors and pumps for use in their own machinery. Initial production of both motors and pumps is expected by March 1, 1949.

Cutler-Hammer, Inc., Milwaukee, has occupied new and expanded quarters for both its sales office and warehouse at 1331 Dragon St., Dallas, Texas.

The current issue of "Production Road", house organ of Twin Disc Clutch Company, is a special "30th Anniversary Issue". In addition to showing a number of engines, machines and pieces of equipment current in 1918, the brochure pictures a range of modern applications of Twin Disc clutches, couplings, converters, power takeoffs and reduction gears.

Ward Leonard Electric Co., Mount Vernon, N. Y., announces that their Rochester branch office has been moved to 66 South St., Rochester 7, N. Y. Ken Savage remains as district manager.

SAE Aircraft Committee Meets

SAE Committee A-6, Aircraft Hydraulics and Pneumatic Equipment, held a two day meeting at the Hollywood-Roosevelt Hotel, Hollywood, Calif., October 4 and 5. B. R. Teree, hydraulic manager of the Weatherhead Company, is chairman of this committee. The meetings were attended by approximately 80 hydraulic engineers of the aviation and equipment manufacturing and supply industries and of the using agencies of the government.

A very full agenda was worked through, with a number of projects reported on and discussed. Among the major projects were AN-H-2 Spec, "Hydraulic Systems; Design, Installation and Tests of Aircraft" and "Non-Flammable Type Hydraulic Fluid". The AN-H-2 Spec is a tentative one and it was discussed in detail. A number of suggested changes and clarifications were hammered out as a result of the session. Some of these suggestions had already been agreed upon by a group of west coast hydraulic engineers at a meeting at the Santa Monica plant of the Douglas Aircraft Company on September 30.

In the discussion on Non-Flammable Type Hydraulic Fluid, Fred O. Hosterman, hydraulic engineer, Lockheed Aircraft Corp., reported on the present status of the AMS 3150 specification, citing the evaluation tests conducted at the Cornell Aeronautical Laboratory. Mr. Hosterman also reported on the progress on a specification for a more completely non-flammable low temperature fluid, which is being compiled by the Aircraft Research Technical Committee. He reported that the draft is approximately 85 percent complete and that it is expected to be ready in about 60 days.

The preliminary report of the Sub-Committee on Hydraulic Nomenclature was given by Mr. Barnes, research engineer of Saval, Inc., in the absence of Sub-Committee Chairman L. S. Barksdale, president of Saval, Inc. Since copies of the report had been late in reaching committee members and other key men, a 30-day additional period was allowed for written comments.

The next meeting of the A-6 Committee will be held in Washington, D. C., late in April 1949.

BOOK REVIEW

Elementary Engineering Electronics

Andrew W. Kramer. *Managing Editor, "Power Plant Engineering." 344 pages, 5 x 8¼ inches. Published by Instruments Publishing Co. Price $2.00.*

The basic facts on practical electronics written by a pioneer electronic engineer who also is a skilled writer—should be a good combination—and is—for the industrial reader whose work requires he have a working knowledge of electron tubes and circuits. The thirty-four short chapters are written for practical men by a practical man; no mathematics beyond the simplest algebra is required; even the few easy electronic formulas may be skipped by readers whose interest is to select equipment.

The emphasis is on measurement and control or "instrumentation". Most of the book is given over to explanations as to how electron tubes work and how they may be made to serve useful purposes. Whenever possible, use is made of mechanical or hydraulic analogies. For example, in Chapter VII on the thyratron, a mechanical thyratron is introduced to help clarify its electrical counterpart. Over 250 illustrations, most of them helpful diagrams and charts, and a good index make this book a good place for the non-electrical designer or engineer to start or carry on his practical vacuum tube and circuit knowledge.

Applied HYDRAULICS DIGEST

Abstracts, summaries and listing of articles on hydraulic and associated applications in industry; reports on prepared papers, talks and discussions of special interest to the hydraulics field.

How Dry is Air?

Ed Holbrook, *Operating Engineer,* v 1, September 1948, pp 48-49.

Since, as the author states, most of the water troubles in compressed air systems can be greatly reduced or entirely eliminated with satisfactory cooling, expansion-type installation and adequate draining of collected moisture, he outlines and shows schematic views of installations which keep moisture out of air shop lines.

Testing IS a Function of Product Development

Dr. G. P. Daiger, *Electrical Manufacturing,* v 42, October 1948, pp 167-171, 230, 232, 234, 236.

A program of testing throughout development of a new product as practiced by The Hoover Company is outlined by the executive engineer of that company. Such tests are chronologically divided into three groups: initiation tests of a new product; product development tests; and "finalized" product design or "prove-in" tests. Types of tests made are functional, safety and durability or abuse testing procedures. A procedure for setting up test check lists is suggested to meet both domestic and foreign standards. The problem of manual vs automatic testing is discussed and illustrated by various testing equipment.

Hydraulic Drives

Carl C. Lindbloom, *SAE Journal,* v 56, October 1948, pp 53-57.

A digest of the paper "Hydraulic Drives" presented April 2, 1948 at the SAE Colorado Section; May 12, British Columbia Section, and May 19, Southern California Section.

The advantages of infinitely variable hydraulic torque converters are listed and both the Lysholm and Schneider contributions are out-

GROBAN'S SURPLUS BARGAINS!

BRAND NEW

Air or Oil HYDRAULICS

Use hydraulic cylinders on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1. Double action, 1½" bore, 5" stroke, will lift 1760 lbs. in one second with Vickers MF 6 Pump. Wt. 3 lbs. A $35.00 value.....Postpaid $8.95
2. Double action, 1½" bore, 9" stroke, will lift 1760 lbs. in one second with Vickers MF 6 Pump. Wt. 4 lbs. A $45.00 value.....Postpaid $10.95
3. Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke, (will lift 1760 lbs. in 2 seconds with Vickers Pump). Wt. 8 lbs. A $55.00 hydraulic cylinder value for only.....Postpaid $12.95
4. Double action, 2⅜" bore, 8" stroke. Will lift 4400 lbs. in one second with Vickers Pump. Will withstand 1500 psi against wall. Wt. 7 lbs. $65.00 value.....Postpaid $14.50
5. Double action, 3" bore, 12" stroke. All steel hydraulic cylinder, will lift up to 12000 lbs. (7000 lbs. in 3 seconds with Vickers Pump.) Complete with fittings. Wt. 12 lbs. $78.60 value.....Postpaid $19.50
6. Double action 3½" bore, 11" stroke (will lift 9600 lbs. in 7 seconds using Vickers MF 6 Pump). Complete with fittings. Wt. 15 lbs. A $92.00 value.....Postpaid $22.50

BRAND NEW HYDRAULIC CONTROL VALVES

Outlets are standard ⅛" pipe thread and inlet takes standard ¼" copper tubing fitting.

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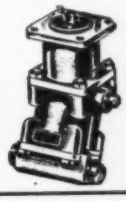

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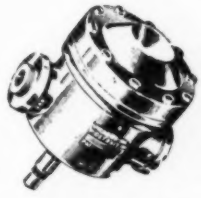

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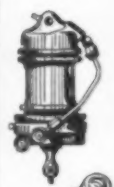

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lined. The principal emphasis is given to the White Hydrotorque Drive, a multi-stage unit with a single centrifugal pump, two reaction members and three turbine stages. The functioning of the torque converter in an automotive vehicle is discussed in detail. Excellent drawings and efficiency charts are shown.

Air-Operated Milling Fixture for Machining Parallel Surfaces

Harold E. Murphey, *Machinery,* v 55, October 1948, pp 196-197.

An air-operated milling fixture for straddle-milling a textile machine bobbin finger, in which two air cylinders are arranged in tandem for simultaneous clamping of both ends of the work, is described and shown in a detailed print. The cylinders are mounted on the base of the fixture and move an operating stud which slides through a bearing to open and close a clamp-operated lever against the work. A tension spring returns the lever to its original position when the operating stud is retracted.

Rotary Contour Formed Parts

Cyril J. Bath, *Product Engineering,* v 19, October 1948, pp 117-120.

The technique of forming contours, particularly of long sweeping curves and compound curves by stretching metal held in a forming die on a hydraulically actuated rotary table, is described. The advantages of compression and of stretch forming are discussed and the limitations pointed out. Illustrations and dimensional part sketches are shown.

Air Power Turned Targets at Olympiad

Anonymous, *Compressed Air Magazine,* v 53, p 253.

The "bobbing" type of targets used by the Olympic pistol shooters this past summer were moved "on" and "off" by air cylinders controlled electronically. Four groups of five targets were each equipped with a solenoid-controlled air cylinder. The piston rod of each cylinder was connected to a long angle iron to which a series of five bell cranks were bolted. As the solenoid valve was actuated, air was admitted to the cylinder, giving the targets a quarter turn to the "on" position; after a precision predetermined "on" time, the solenoid reversed the cylinder, snapping the targets to the "off" position. Control was automatic after the target "on" time was preset in the control station. The electronic equipment was designed by technicians of the Royal Air Force. Two 3 hp compressors supplied air for the setup. As far as known, this was the first use of electronically controlled air cylinders for handling targets.

PERSONALS

JOHN H. BATTEN, formerly executive vice president, has been elected president of the Twin Disc Clutch Company, according to an announcement by the company's Board of Directors. He joined Twin Disc following his graduation from Yale in 1937. He succeeds his father, P. H. Batten, founder of the company, who becomes chairman of the Board of Directors. Other officers were re-elected: Soren Sorenson, vice president, manufacturing; N. F. Adams, vice president, sales and engineering; G. L. Shuman, secretary-treasurer; R. T. Rehwald, assistant secretary and R. T. Howell, assistant secretary.

Mr. Batten

LLOYD L. LEE has been named by Cleveland Republic Tool Co. as manager of their Detroit office.

A. R. KELSO has been appointed executive vice president of Federal Machine & Welder Co., Warren, Ohio. Mr. Kelso will have administrative charge of all divisions of the company.

DALE D. SPOOR has been named manager of the equipment sales department of Air Reduction Sales Co.

DR. FRANK DANA CARVIN has been named head of the department of mechanical engineering at Illinois Institute of Technology. He formerly was head of the mechanical engineering department and chairman of the graduate division at Newark College of Engineering.

E. W. CHAPMAN has been named vice president in charge of engineering for the Tuthill Pump Co., Chicago.

S. R. ZIMMERMAN, JR. has been named director of friction material research and development for Raybestos-Manhattan, Inc., Passaic, N. J.

MAX BRADSHAW has been appointed by Allis-Chalmers Mfg. Co., Milwaukee, as district manager for Ohio, West Virginia and Western Pennsylvania.

C. E. TWEEDLE, assistant to the president of the Askania Regulator Company, was elected vice president of the company at the last meeting of the Board of Directors. H. J. Velten, president, made the announcement. Mr. Tweedle has been associated with Askania since October, 1946, since his release from the Navy in which he served as Commander and was Executive Officer of the Administration Command, Great Lakes Naval Training Center. A graduate of Illinois Institute of Technology, Mr. Tweedle was engaged in consulting engineering work prior to the war.

Mr. Tweedle

J. C. KUHN has been appointed general sales manager of the Morse Twist Drill & Machine Co., according to an announcement by JAMES Y. SCOTT, president of the company. Mr. Kuhn comes to Morse from the Blackhawk Mfg. Co., of Milwaukee, for whom he was eastern district sales manager.

ARTHUR A. BERARD was recently elected president and general manager of the Ward Leonard Electric Co., Mount Vernon, N. Y. Mr. Berard, who served as vice president and general manager of the company since 1944, succeeds Dawson J. Burns, who was elected chairman of the Executive Committee.

FRANK H. WEBBER has joined the sales staff of Pennsylvania Refining Co., Cleveland. Mr. Webber, a veteran of 30 years sales experience in the oil business will serve the Cleveland and northern Ohio areas.

ROY F. CRATTY has joined the Industrial Advertising Division of Cramer-Krasselt Co., Milwaukee. He has previously been associated in Rockford with Greenlee Bros. & Co., George D. Roper Corp., Pump Division and Burd Piston Ring Co. Previous to this he was branch advertising man for the International Harvester Co. of Milwaukee.

KENNETH G. DONALD has been elected president of Jack & Heintz Precision Industries, Inc., Cleveland, succeeding Byron C. Foy. Mr. Donald was elevated from the position of general manager.

CARL J. LAMB has been appointed as consulting engineer for the Hydraulic Press Mfg. Company, Mt. Gilead, Ohio. Mr. Lamb has had a wide experience in the hydraulic machinery and equipment design field. He was graduated from the Naval Academy, class of 1918, and spent 5 years in active service during the recent war. He has served with such organizations as Westinghouse Electric Corporation, The Sharples Corporation and Hydropress, Inc.

Mr. Lamb

HENRY M. HARROLD has been appointed by the Hannifin Corp., Chicago, as vice president of operations of Bridgman Castings, Inc., Bridgman, Mich., a subsidiary. Mr. Harrold joined the company early this year, coming to them from the Sperry Gyroscope Co.

OTTO G. SCHWENK has been named by the Yale & Towne Mfg. Co. as vice president in charge of production.

SOL MARDER of the Planning Department of Purolator Products, Inc., won first prize with his suggestion of "The Micronicle" as the name for the new Purolator plant publication.

CYRIL J. BATH, president, The Cyril Bath Company, Cleveland, announces the acquisition of the Goodyear patents on Rotoforming in the United States, Canada and England. This process, originated simultaneously by Bath and the Goodyear Aircraft Co. during the war, has been developed by Bath with hydraulic equipment to contour form metal parts.

PROFESSOR GREGORY J. COMSTOCK has been retained by the Lake Erie Engineering Corporation, Buffalo, N. Y., as a consultant in the field of powder metallurgy.

GEORGE W. PERRY has been named advertising manager of the Cook Electric Co., Chicago.

WILLIAM A. GRAMBO, until recently designer with the Milwaukee Hydraulics Corp., West Allis, Wis., has joined the Steam Turbine Department of Allis-Chalmers Mfg. Co.

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Excellent opportunity for mechanical engineer with some hydraulic design experience for first-line manufacturer of hydraulic automotive equipment in Wisconsin. Include full personal and experience data in reply with salary expected. Box 11148.

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